2022 ASSESSMENT REPORT

MTM315117 - Mathematics Methods - Foundation

Part 1: Non-Calculator Section

GENERAL COMMENTS:

- Some students were very inaccurate with the sketching of graphs resulting in graphs which were not mathematically accurate. Whilst some leeway was granted, a number of students were penalised for substantial inaccuracies caused by a lack of care when sketching. Students are encouraged to use pencil for their graphs (so they can erase errors), use a ruler if they need to draw axes and to ensure they draw one smooth line/curve which accurately passes through the relevant points.

- Any question worth 2 marks or more **must** include some appropriate working or full marks will not be gained.

- Students need to develop better skills with basic multiplication, fractions and indices work, and for algebraic manipulation questions when solving for x.

PART 1 (CRITERION 4)

Question	Part	Marks	Comments
Q1	(a)	1	• Generally, well attempted and completed by students. • Most frequent error source was confusion balancing fractions when finding the common denominator. • Many successful students cross multiplied.
	(b)	2	• Well completed overall. • A significant number of students did not apply the null factor theorem, but expanded and refactored.
Q2	(a)	1	• Well completed overall. • Most common error source was subtracting indices fully and accurately.
	(b)	2	• Frequent errors made with this question. • Common error sources included students raising only part of bracketed terms to index; inaccurate collation of indices

Question	Part	Marks	Comments
			when simplifying; not presenting final answer with positive indices. • Question was presented with $m \times n$ in the numerator and this changed to $n \times m$ in the denominator; this was a trap for some students.
Q3		3	• Question was frequently answered incorrectly. • Most common error source was the "non-division" initially by the coefficient of the x^2 term. • Mechanics of completing the square was quite well completed by students. • Students frequently did not compensate for the initial factor of 2 when expanding to final form of $a(x - h)^2 + k$.
Q4		3	• Question was well completed by students. • Error sources tended to be through inaccuracies when expanding and multiplying numerals to indices of 4 and 3. • Students who chose to use the Binomial Theorem option to expand had difficulty in determining the correct coefficients. • A significant number of students attempted to answer the question as a binomial expansion.
Q5	(a)	1	• Very well completed with most students answering the question correctly.
	(b)	2	• Initial extraction of common factor was completed accurately by most students. • A significant number of students left the expression with just the common factor removed, not recognising or applying the sum of cubes, often writing $3(x + 2)^3$. • In general students attempting the sum of cubes did so with a high level of accuracy.
Q6		1	• Very well completed with most students answering the question correctly.

PART 2 (CRITERION 5)

Question	Part	Marks	Comments
Q7	(a)	2	Most students completed this question well. Students who were successful generally showed the steps to rearrange the equation into $y = mx + c$ form. Mistakes included not dividing all terms by 2.
	(b)	2	Most students completed this question well. Students should remember to use a ruler for accuracy. There were some issues finding the x-intercept and students are encouraged to show their working out when finding intercepts or another point.
	(c)	2	Most students completed this question well. Some students found the <u>perpendicular</u> line at the given point, a reminder to read questions carefully.
Q8	(a)	2	Some students completed this well, using different approaches: TP form $y = a(x-h)^2+k$ or intercept form $y = a(x-b)(x-c)$. Small errors occurred when finding "a", especially when rearranging the formula or using the incorrect sign(s) when substituting values into the formula.
	(b)	2	Most students completed this question well. Students who were less successful struggled with rearranging the formula to determine the value of "a", or using the incorrect sign(s) when subbing in "h" and "k".
Q9		2	Students generally struggled with this question. Markers were looking for the key aspects of the graph to be correct; not reflected ($a>0$), positive y-intercept ($c>0$), two x-intercepts ($\Delta>0$) and a positive x-value in the turning point ($b<0$). Students are encouraged to add notes to the information given to help them work their way through the problem.
Q10		2	Most students completed this question well. Mistakes included:

Question	Part	Marks	Comments
			○ incorrectly identifying $\frac{31}{5}$ as the maximum instead of 7.496; ○ Incorrect use of open and closed brackets, i.e., "(" is an open bracket indicating point is included, "[" is a closed bracket indicating the point is not included. ○ listing domain and range max and min values in the wrong order (values should be listed from minimum to maximum).
Q11		2	Most students correctly indicated that this graph was a function; however, markers were also looking for justification to obtain full marks. It was sufficient to say that it "passed the vertical line test".

PART 3 (CRITERION 6)

Question	Part	Marks	Comments
Q12	(a)	2	Students who did well on this question knew that $\sqrt{3} = 3^{\frac{1}{2}}$ and solved for x.
	(b)	2	Students who did well on this question knew that $25^x = 5^{2x}$ and $\left(\frac{1}{5}\right)^{(2x-6)} = (5^{-1})^{2x-6}$ and solved for x.
	(c)	2	Students who did well on this question used the log laws correctly to state that $\log_5(x-1) + \log_5 3 = \log_5(3x-3)$.
Q13	(a)	2	Students who did well on this question clearly showed and labelled the asymptote, clearly labelled the x-intercept and drew a smooth exponential curve.
	(b)	1	Students who were less successful made errors in the domain or range by swapping components or confusing domain and range.
Q14	(a)	1	Students who did well on this question made the correct conversion by multiplying by $\frac{\pi}{180}$.

Question	Part	Marks	Comments
	(b)	2	Students who were less successful did not realise that $\sin 30° = 0.5$. Some students left off units in their final answer. Some students used the sine rule which was accepted as correct.
Q15	(a)i	1	Students who were less successful stated the period as 2π.
	(a)ii	1	Students who were less successful stated the amplitude as -3.
	(b)	2	Students who were less successful had poorly shaped $\cos x$ in their graph, or an incorrect period, drew a $\sin x$ graph or had multiple lines in their graph. Students are encouraged to use the spare graph if they make a mistake.

PART 4 (CRITERION 7)

Question	Part	Marks	Comments
Q16	(a)	1	Most students were able to answer this question correctly. On few occasions students incorrectly expressed their final answer in terms of y instead of correctly using y' or dy/dx.
	(b)	2	Most students were able to answer this question correctly. Mistakes were made when the brackets weren't expanded correctly but differentiated correctly with an error carried forward. On very few occasions the equations weren't distinguished between y and y' (or dy/dx).
Q17		2	Most students received part or full marks for this sketch. Most errors consisted of incorrect shape (either a -x2 or linear derivative graph) and inaccurate x intercepts. On occasion, the parabolic shape of the derivate was poorly drawn. Students are reminded that turning points for parabolas occur ½ way between x-intercepts.
Q18		2	Most students were able to answer this question correctly for full or part marks. Common errors consisted of incorrect numerator (i.e., 12.7-7=12) or missing units.

Question	Part	Marks	Comments
Q19		3	Most students were able to answer parts of this question correctly. Some students received full marks. The derivative was commonly correct. The most common error students made was substituting the gradient into the derivative on the wrong side of the equal sign (i.e., 0=2x4+2) which created an error in the x and y coordinates. Of these students, most found the correct equation (with the error carried forward) but some continued on to make further mistakes.
Q20	(a)	2	Most students calculated the correct displacement for the 2 time (t) values. The most common error students made was to find the derivate and substitute the time values into the derivative, or to make a basic calculation error multiplying the numbers. Common errors included students neglecting to write the negative sign in "-4 km" and not writing correct units.
	(b)	2	If students answered the previous question correctly, Part (b) was usually correctly answered as well. The most common mistake was not writing in units. Students who made a basic calculation error in Part (a), mostly answered Part (b) correctly, but with an error carried forward. Students who incorrectly answered Part (a) (by differentiating initially), generally couldn't answer this question.
	(c)	2	Most students answered this question correctly (if they answered the previous 2 questions correctly) and found the derivative equation and completed the calculation. Students who incorrectly answered Part (a) generally couldn't answer this question.

Question	Part	Marks	Comments
			Common errors were, not including units and simple basic calculation errors such as below: i.e. s'=8t-8 =8(5)-8 =48-8 =40

GENERAL COMMENTS:

The Calculus section of the paper was done very well by most students.

PART 5 (CRITERION 8)

Question	Part	Marks	Comments
Q21	(a)	2	This question was answered well by most students. Students who misplaced numbers on the table from the given information generally had less understanding of probability, often finding sums well above 1. As a result, they generally lost both marks here, but made up for it in part (b) of the question with an error carried forward.
	(b)i	1	This question was very well answered by most students.
	(b)ii	1	This question was generally well done.
Q22	(a)	1	This question was very well answered by most students
	(b)	1	This question was generally well answered by most students. A small proportion added instead of multiplying the fractions and a larger proportion struggled to simplify the product of fractions.
Q23	(a)	1	This question was generally well done.
	(b)	2	This question was generally well answered. A common mistake was making $n(R \cap D) = 10$ instead of 14. They

Question	Part	Marks	Comments
			missed the fact that the intersection of 3 sets is also part of the intersection of just 2.
	(c)	2	Quite a number of students struggled with this question. Establishing the required area from the Venn diagram with 3 intersecting sets proved tricky. In particular, finding $\mathrm{n}(D' \cap (R \cap C'))$, in order to calculate the conditional probability was challenging for quite a few.
Q24	(a)i	2	Generally, students had a good idea of what to do for this question, even if it was just to include the formula for independent events. Quite a number struggled to multiply decimals.
	(a)ii	1	Errors made here were not reading the question, answering Yes/No or misunderstanding what mutually exclusive sets are.
	(b)	2	This question was generally well handled. Mistakes were often made when simplifying the decimal expression. Quite a few students divided by $\Pr(B)$ instead of $\Pr(A)$, for conditional probability (i.e. $\Pr(B\|A) = \frac{\Pr(A \cap B)}{\Pr(B)}$).

Part 2: Calculator Section

PART 1 (CRITERION 4)

Question	Part	Marks	Comments
Q25	(a)	1	Most students answered well. The majority of students used correct, given variables.
	(b)	3	Elimination method had more success than substitution method. Many students performed the question without their calculator and there were some calculation errors. Students are encouraged to check answers on their calculator using the simultaneous function. Most students showed sufficient algebra working.
Q26	(a)	1	Completed very well by most students.
	(b)	3	Completed very well by most students.
	(c)	2	Markers required evidence of null factor law or evidence of function equally zero. This was not included by most students.
Q27	(a)	1	Completed very well by most students
	(b)	2	Done well, algebraic working was obvious.
Q28		2	Many students struggled to simplify to exact values. Decimals offered given. Some students did not use the quadratic formula correctly.
Q29	(a)	1	Completed very well.
	(b)i	2	Mostly well done. However, a common error was 12/4 instead of 4/12.
	(b)ii	2	This question was poorly attempted. Most common was finding 2 real solutions, but not recognising the need to use a square number. Success was found by equating the discriminant to a square number of choice and solving for c.

GENERAL COMMENTS:

Overall C4 was well answered by most students.

PART 2 (CRITERION 5)

Question	Part	Marks	Comments
Q30	(a)	2	Turning point was identified by most students. There was a lot of variation on discussion of its structural significant.
	(b)	3	Most students had some success graphing this function. Most students chose a relevant domain and range and shape. Some students' responses would indicate that they struggled to use CAS effectively as Zoom Auto did not work.
	(c)	1	Done well.
	(d)	2	Overall done well. Most common error was finding only one intercept. Some students found two solutions and dismissed one, rather than using subtraction.
Q31		3	Majority of students did well and recognised double intercept.
Q32	(a)	2	Those who succeeded, either solved using simultaneous equations on CAS or substitution method. Poorly understood by many students. Most common error was using the given values and one set of co-ordinates. This was not sufficient.
	(b)	1	Well done by most students.
	(c)	2	Most common error was using the maximum given (3.5, 1) rather than the correct value (4, 0.874).
Q33	(a)	2	Generally done very well.
	(b)	2	Well done. Most common error was not labelling the y-intercept and turning point.

GENERAL COMMENTS:

Students who used their calculators effectively were rewarded with higher marks in this section.

PART 3 CRITERION 6

Question	Part	Marks	Comments
Q34		1	Students found this question challenging, with many choosing to move on. However, students who identified the correct quadrant and considered their exact values chart were able to receive partial marks.
Q35	(a)	1	This question was well done. Some common errors included setting $n = 1$ or misusing index laws so that $a^0 = a$.
	(b)	2	This question was done well. Markers were looking for evidence of the correct value substitution, after which students who used their calculator to solve for n without attempting to re-arrange by hand generally fared better-off.
Q36	(a)	2	Students who wrote the Pythagorean identity and identified cos as positive in quadrant 4 were successful in this part. A common mistake was applying a square root without showing evidence of considering both the possible positive and negative solutions.
	(b)	1	Students who identified the correct basic identity to use received partial marks for this part and were often able to get full marks with error carried forward using their previous answer.
Q37	(a)	3	This question was well-attempted by most students. Challenges involved using both points with correct use of log laws. It was pleasing to see students solving simultaneous equations with their calculator to find values of a and k.
	(b)	2	The most common errors here were the order of transformations and wording the dilation in the direction of

Question	Part	Marks	Comments
			the y-axis is important as it is the function, not the axis, that is being dilated.
Q38	(a)	1	This question was done very well. It would be good to see more students include units in their answer.
	(b)	3	Students who paid attention to detail by maintaining the amplitude and sketching symmetrically found great success in this part of the question. Partial marks were awarded for sinusoidal shapes beginning at the origin that did not change amplitude.
	(c)	2	Students who attempted this question were often rewarded with marks for any errors carried forward. Most students identified the maximum temperature and the value of h although many did not consider the time of day (6 hours after 8am).
Q39		2	Most students correctly identified that they needed to use the sine formula to solve this question. The angles and lengths were generally substituted in the correct places, but algebraically re-arranging and taking the inverse of sin proved to be a challenge. The most successful students were those who used their calculator to solve without doing any re-arranging by hand! As always, careful consideration of what mode the graphics calculator should be in – radians, gradians or degrees – paid off.

PART 4 (CRITERION 7)

Question	Part	Marks	Comments
Q40	(a)	2	Students who were successful with this question were able to determine $L = 200 - 2W$ and substitute into the area formula.
	(b)	2	This question was generally well answered by students. Common errors included missing $\frac{dA}{dw} = 0$ and missing units. Note: it was not necessary to complete part (a) to access the remainder of this question.

Question	Part	Marks	Comments
	(c)	1	This answer was well answered by students.
Q41		3	Students found this question quite difficult with many failing to differentiate before substituting x=2 and x=4. Too many students substituted into the original function. Many arithmetic errors were made. Students should aim to show meaningful solutions using their calculator to check/validate arithmetic along the way. The use of the calculator to sketch and check solutions is strongly encouraged.
Q42		3	Many students could not follow through complete working for this standard question. Common errors included placing the limit notation on the wrong side of the equals sign (or omitting it entirely), failing to correctly expand $(x+h)^2$, failing to correctly deal with the negative sign for $-3(x+h)$ and so on. Many students stated "$h=0$", showing a lack of understanding of limits and the theory behind the "first principles" method of differentiating.
Q43	(a)	3	Students who did well on this question used their calculator to factorise the quadratic. A number of students had difficulty solving the factorised quadratic and incorrectly solved $3(x-1)^2$ to give solutions of $x=1$ and $x=0$ or $x=1$ and $x=3$. Many students also forgot to find the y-coordinate of the stationary point or assumed it was 0.
	(b)	2	For full marks students were able to use either a derivative table or the second derivative to answer this question. Many students were able to find gradient values but were then unable to correctly interpret the result. Markers were looking for students to explicitly state that the stationary point was a point of inflection.
Q44		4	Pleasingly, most students knew what approach to take with this question. Markers were not looking for detailed algebraic working and those who used their calculator to assist did well on this question. Common errors came from incorrect arithmetic, including errors evaluating 12-

Question	Part	Marks	Comments
			21+12. A number of students wrote $y = 3$ instead of $m = 3$ or $\frac{dy}{dx} /= 3$.

PART 5 (CRITERION 8)

Question	Part	Marks	Comments
Q45	(a)i	1	This question was generally well answered by students.
	(a)ii	1	Students who were less successful with this question added the two combinations rather than multiplying.
	(b)	2	This question was generally well answered by students.
Q46	(a)	2	Students who were less successful incorrectly wrote Science and English around the wrong way or totalled the number of students studying either English or Science to be 100. Note: using a Karnaugh Table to find the missing values in the Venn Diagram is helpful.
	(b)i	1	This question was generally well answered by students.
	(b)ii	2	Students who were less successful gave the probability of English given Science rather than the other way around, or selected a denominator of 38 rather than 62. To receive full marks, solutions needed to be simplified.
Q47	(a)	2	Students should be aware that probabilities should be written on the branches, not at the end of each branch.
	(b)	2	Students who were less successful on this question multiplied Tuesday's "rain" probabilities together, which was incorrect. Probabilities should be multiplied along the branches and added between branches.
	(c)	2	In this question, markers were looking for evidence of mathematical independence. Mathematical independence is demonstrated either by the product

			rule or by conditional probability. It is rarely sufficient to "explain" independence by description. Secondly, when demonstrating that $P(A \cap B) \neq P(A)P(B)$, it is poor practice to set both sides equal to each other and then show they are not. Instead, calculate each side separately, and then conclude that $P(A \cap B) \neq P(A)P(B)$.
Q48			For this question, students who were more successful tended to use more efficient methods for calculating combinations.
	(a)	1	This question was generally well answered by students.
	(b)	2	This question was generally well answered by students. Students who were less successful added the combinations rather than multiplying.
	(c)	2	Although many students were successful in finding the correct answer by considering the different combinations, the most efficient method was by considering the complementary event $1 - P(two\ the\ same)$. $P(two\ the\ same)$ was easily calculated from parts (a) and (b).

SOLUTIONS ON THE FOLLOWING PAGE

OFFICE OF TASMANIAN ASSESSMENT, STANDARDS & CERTIFICATION

ANSWERS/SOLUTIONS

External Assessment 2022

29 JUL 2022

MATHEMATICS METHODS FOUNDATION

MTM315117

Section A

Pages	24
Questions	24
Information Sheet	1

Preparation time for this exam: 15 minutes

Suggested working time: 80 minutes

Instructions:

Calculators are not allowed to be used.

Section A will be collected after 80 minutes.

- There are **five (5)** parts to this section.
- Answer **all** questions and **all** items within each question.
- Write your answers in the spaces provided in this exam paper.
  - Spare diagrams have been provided at the end of each part. Indicate in the box provided if you have used the spare diagrams.
- The exam is **three (3)** hours in length. It is suggested that you spend **approximately 80 minutes** in total answering the questions in this exam booklet.
- During the first 80 minutes you may move onto Section B, but you **cannot** use your calculator until told by your supervisor (s).
- The **Mathematics Methods Foundation Information Sheet** can be used throughout the exam.
- All answers must be written in **English**.
- You **must** make sure your answers address:
  - Criterion 4 manipulate algebraic expressions and solve equations.
  - Criterion 5 understand linear, quadratic and cubic functions.
  - Criterion 6 understand logarithmic, exponential and trigonometric functions.
  - Criterion 7 use differential calculus in the study of functions.
  - Criterion 8 understand experimental and theoretical probabilities and of statistics.

Marker Use	
C4	/ 16
C5	/ 16
C6	/ 16
C7	/ 16
C8	/ 16

Additional Exam Instructions

For questions worth **one (1)** mark, you are not required to show workings. Markers will look at the presentation of the answer(s) and at the argument(s) leading to the final answer(s).

For questions worth **two (2)** or more marks **you are required** to show relevant workings.

Marks will be allocated:

- according to the degree to which workings convey a logical line of reasoning, and
- for suitable justifications and explanations of methods and processes when requested.

Guide to Exam Structure

	Parts	Questions available	Questions to answer	Suggested working time	Marks available
Section A	Part 1	6	6	16 minutes	16
	Part 2	5	5	16 minutes	16
	Part 3	4	4	16 minutes	16
	Part 4	5	5	16 minutes	16
	Part 5	4	4	16 minutes	16
Totals		**24**	**24**	**80 minutes**	**80**
Section B	Part 1	5	5	20 minutes	20
	Part 2	4	4	20 minutes	20
	Part 3	6	6	20 minutes	20
	Part 4	5	5	20 minutes	20
	Part 5	4	4	20 minutes	20
Totals		24	24	100 minutes	100
Totals		**48**	**48**	**180 minutes (3 hours)**	**180**

Part 1

- Attempt **all** questions in this part.
- This part assesses **Criterion 4**.

Question 1

Marker use

Solve the following for x:

a) $\frac{2x-3}{2} = \frac{x+3}{5}$

$10x - 15 = 2x + 6$

$8x = 21$

$x = 21/8$

/2

b) $(x+7)(8-2x)=0$

$x + 7 = 0$ $\quad$ $8 - 2x = 0$

$x = -7$ $\quad$ $x = 4$

/1

Question 2

Simplify the following expressions, giving your answer in positive index form:

a) $\frac{5a^2b^4 \times 4a^3b^3}{2a^4b^2}$

$\frac{20a^5b^7}{2a^4b^2} = 10ab^5$

/1

b) $\frac{2m^4n^2 \times (3mn^{-3})^2}{(5n^{-3}m^{-1})^2}$

/2

$\frac{2m^4n^2 \times 9m^2n^{-6}}{25n^{-6}m^{-2}}$

$= \frac{18m^6n^{-4}}{25n^{-6}m^{-2}} = \frac{18m^8n^2}{25}$

Part 1 continues

Marker use

Question 3

Transform $2x^2-8x+3$ into the form $a(x-h)^2+k$ by completing the square.

/3

$2(x^2-4x+3/2)$

$=2[(x-2)^2-4+3/2]$

$=2[(x-2)^2-5/2]$

$=2(x-2)^2-5$

Question 4

Using Pascal's triangle or the Binomial Theorem to assist, expand $(3x-1)^4$.

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1

/3

$1(3x)^4+4(3x)^3(-1)+6(3x)^2(-1)^2+4(3x)(-1)^3+1(-1)^4$

$81x^4-108x^3+54x^2-12x+1$

$27\times 4 = 108$

Question 5

Fully factorise:

a) p^2-4

/1

$(p-2)(p+2)$

b) $3m^3+24$ m^3 2^3

/2

$3(m^3+8)$

$3(m+2)(m^2-2m+4$

Question 6

Expand $(x+3)^2$

/1

x^2+6x+9

Total C4

/16

Part 2

- Attempt **all** questions in this part.
- This part assesses **Criterion 5.**

Question 7 | Marker use

For the linear function with equation $2y = 3x - 12$

a) Find the gradient and y intercept.

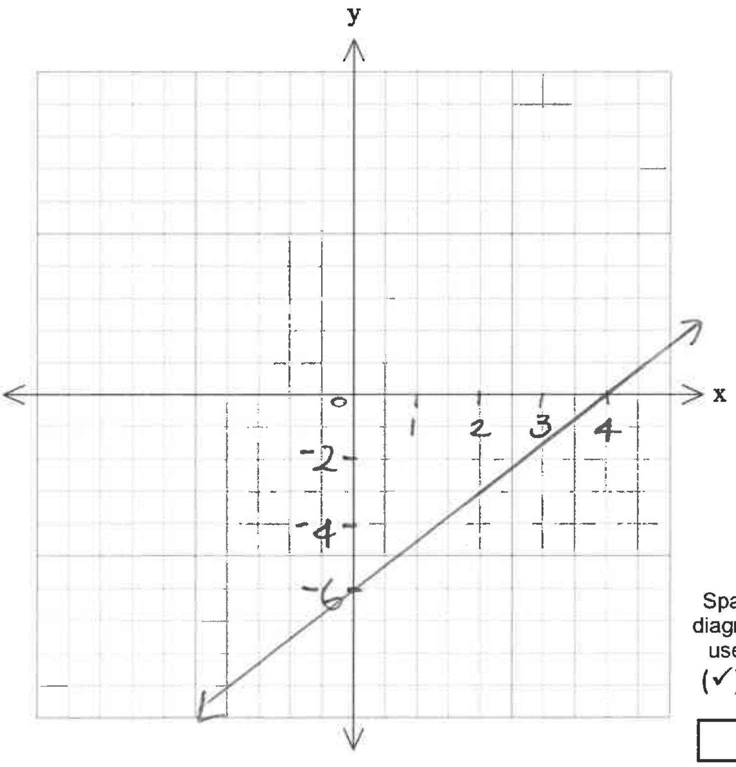
$y = \frac{3}{2}x - 6$ gradient $= \frac{3}{2}$

y intercept $= -6$

/2

b) Graph the function, clearly indicating where the line cuts each axis.

/2



x int $y = 0$

$0 = 3x - 12$

$x = 4$

Spare diagram used (✓) ☐

c) Determine the equation of the line passing through the point (1, 2) that is **parallel** to this line.

for // lines $m_1 = m_2$ $\therefore m_2 = \frac{3}{2}$

$y - 2 = \frac{3}{2}(x - 1)$

$y - 2 = \frac{3}{2}x - \frac{3}{2}$

$y = \frac{3}{2}x + \frac{1}{2}$

/2

Part 2 continues

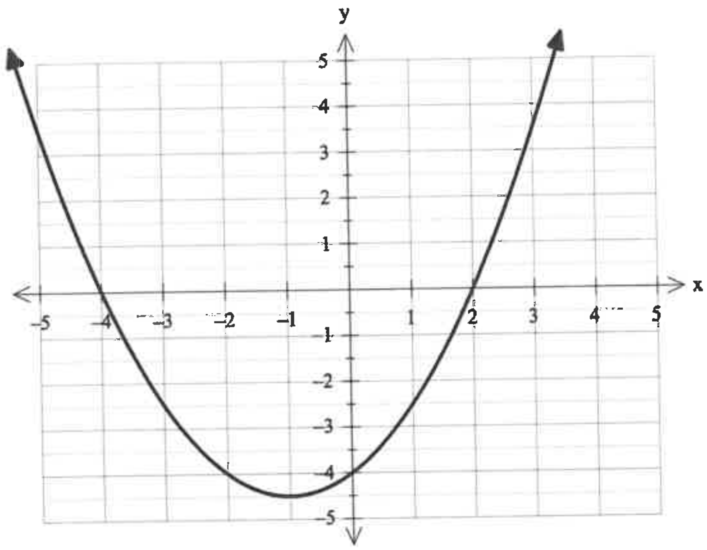
Marker use

Question 8

Determine the equations of the following functions:

a)

/2



$y = a(x+4)(x-2)$

sub $(0,-4)$

$-4 = a(4)(-2)$

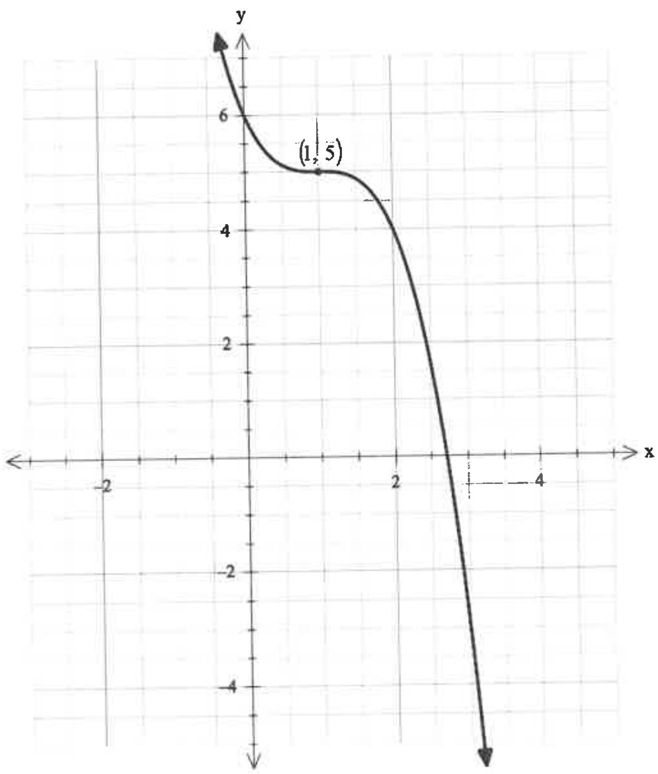
$-4 = a \times -8$

$a = \frac{1}{2}$

$y = \frac{1}{2}(x+4)(x-2)$

b)

/2



$y = a(x-1)^3 + 5$

sub $(0,6)$

$6 = a(-1)^3 + 5$

$1 = a \times -1$

$a = -1$

$y = -1(x-1)^3 + 5$

Question 9

Marker use

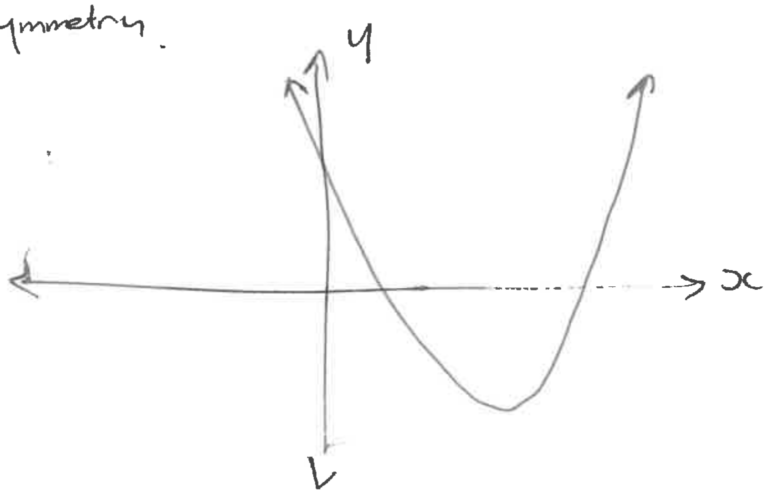
/2

Sketch a possible graph for the quadratic function $y = ax^2 + bx + c$, where:

$\frac{-b}{2a}$ ∴ (+)ve axis of symmetry

∨ yint 2 roots

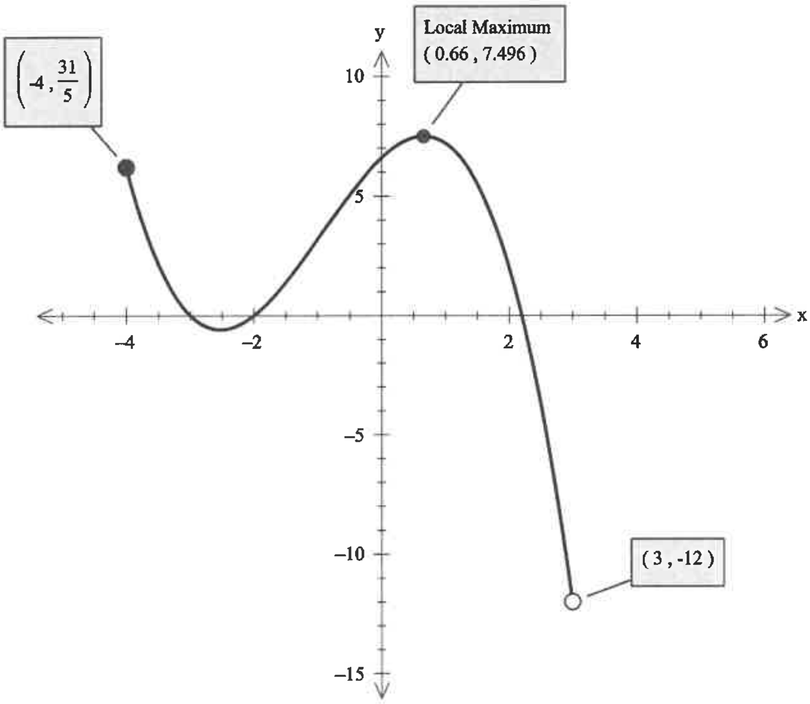
$a > 0,\ b < 0,\ c > 0$ and $\Delta > 0$



Question 10

/2

State the domain and range of the following function:



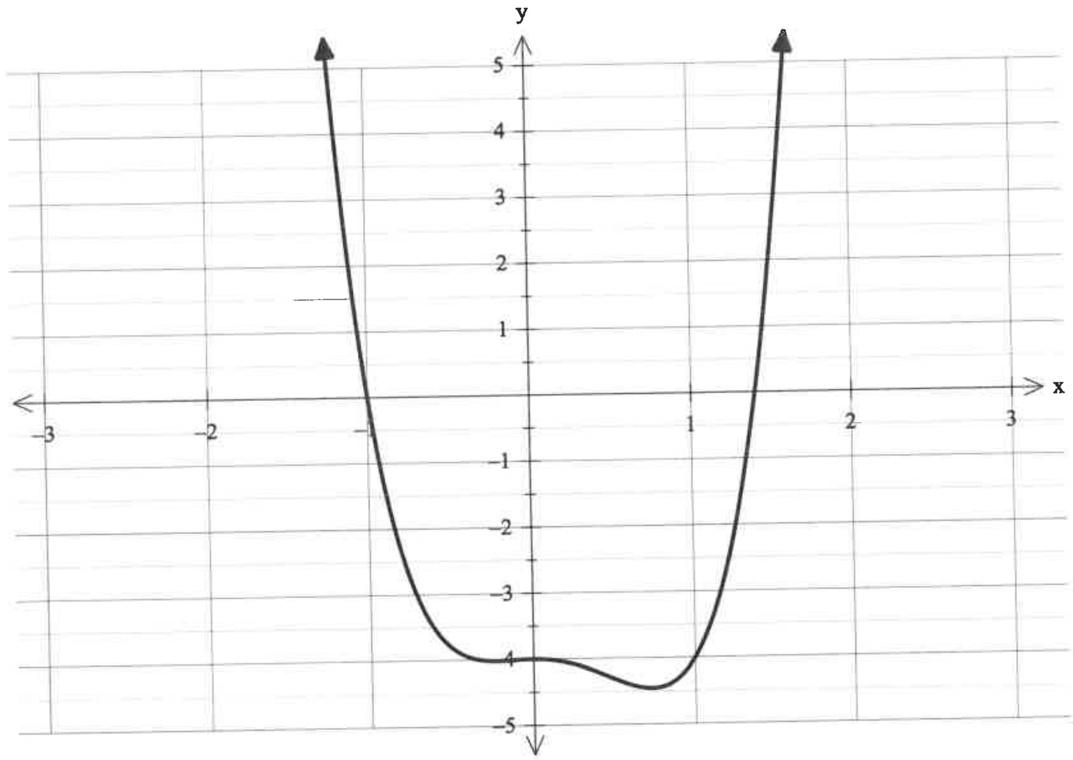
Domain: $x \in [-4, 3)$

Range: $y \in (-12, 7.496]$

Part 2 continues

Question 11

State if the following is a function, giving a reason for your statement.



Yes a function. Satisfies the vertical line test (each x value has only one y value)

Marker use

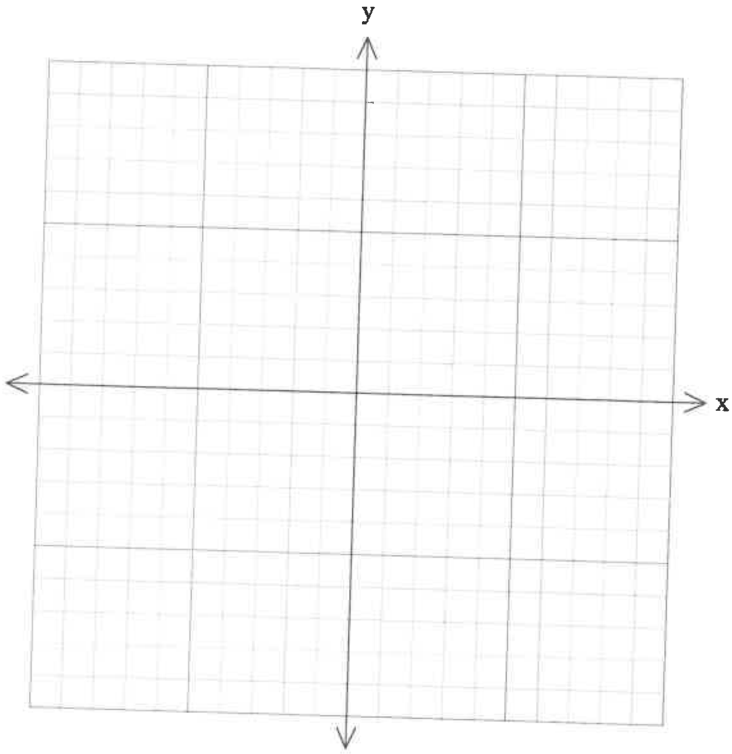
/2

Total C5

/16

Spare Diagram

Question 7 b)



Part 3

- Attempt **all** questions in this part.
- This part assesses **Criterion 6**.

Marker use

Question 12

Solve algebraically for x:

a) $3^{2x-3} = \sqrt{3}$

$3^{2x-3} = 3^{\frac{1}{2}}$ $x = 7/4$

$2x - 3 = 1/2$

$2x = 3\frac{1}{2}$ $(7/2)$

/2

b) $25^x = \left(\frac{1}{5}\right)^{(2x-6)}$

$5^{2x} = (5^{-1})^{2x-6}$

$2x = -2x + 6$

$4x = 6$

$x = 3/2$

/2

c) $\log_5(x-1) + \log_5 3 = 2$

$\log_5(3(x-1)) = 2$

$3x - 3 = 5^2$

$3x - 3 = 25$

$3x = 28$

$x = 28/3$

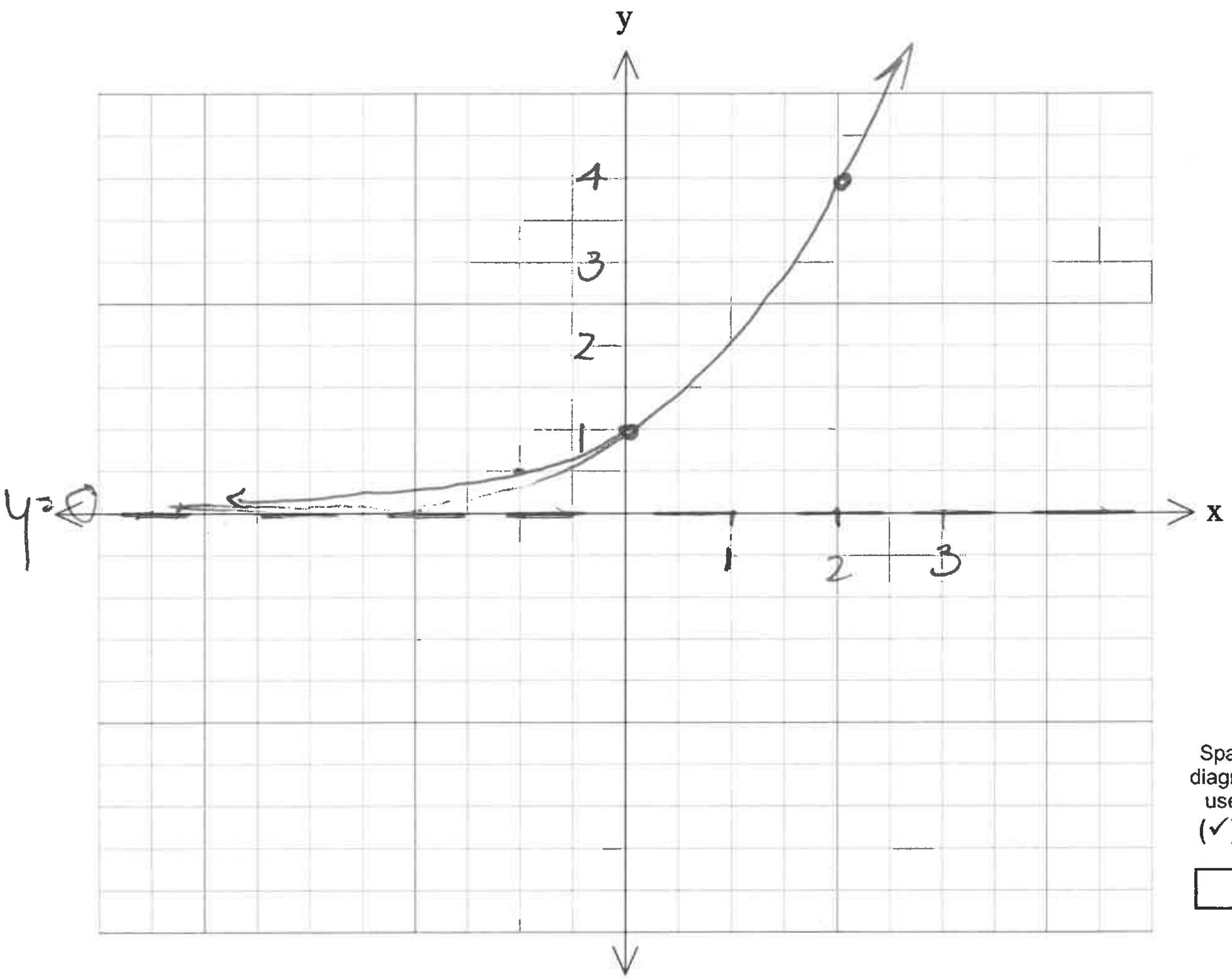
/2

Part 3 continues

Part 3 continued

Question 13

a) Sketch the graph of $y = 2^x$ clearly labelling the asymptote and any axis intercepts.



Spare diagram used (✓)

☐

Marker use

/ 2

b) State the domain and range of this function.

Domain : $x \in \mathbb{R}$

Range : $y > 0$

/ 1

Part 3 continues

Part 3 continued

Marker use

Question 14

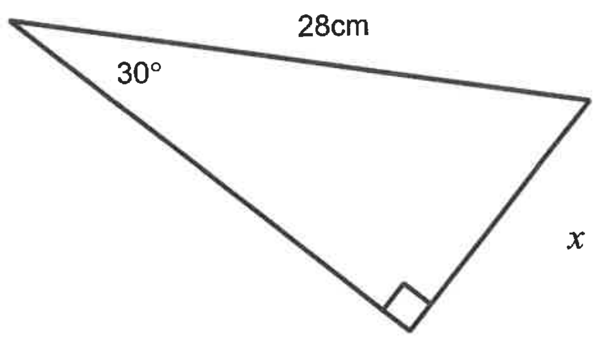
a) Convert 30° to radians

$30 \times \frac{\pi}{180} = \frac{\pi}{6}$

/1

b) Evaluate the length of the side labelled x.

/2



$\sin 30^\circ = \frac{x}{28}$

$x = 28 \times \sin 30^\circ$

$x = 14$ cm.

Part 3 continues

Marker use

Question 15

a) For the function $y = -3\cos(2x)$, state:

i. the period.

period $= \frac{2\pi}{2} = \pi$

/1

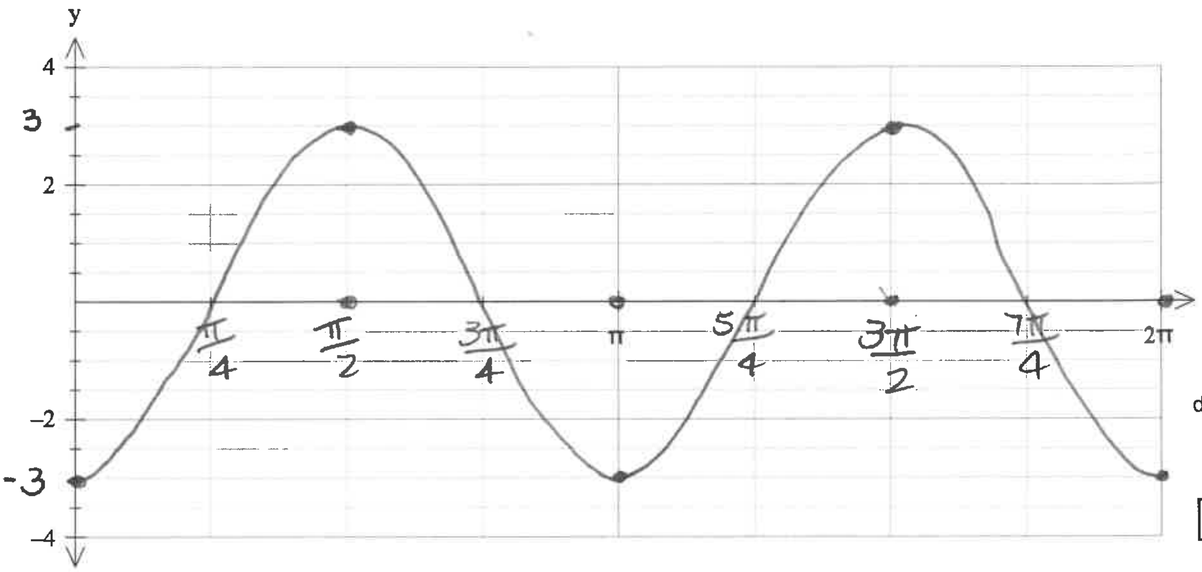
ii. the amplitude.

amplitude $= 3$

/1

b) Sketch the graph of the function over the domain $x \in [0, 2\pi]$.

/2



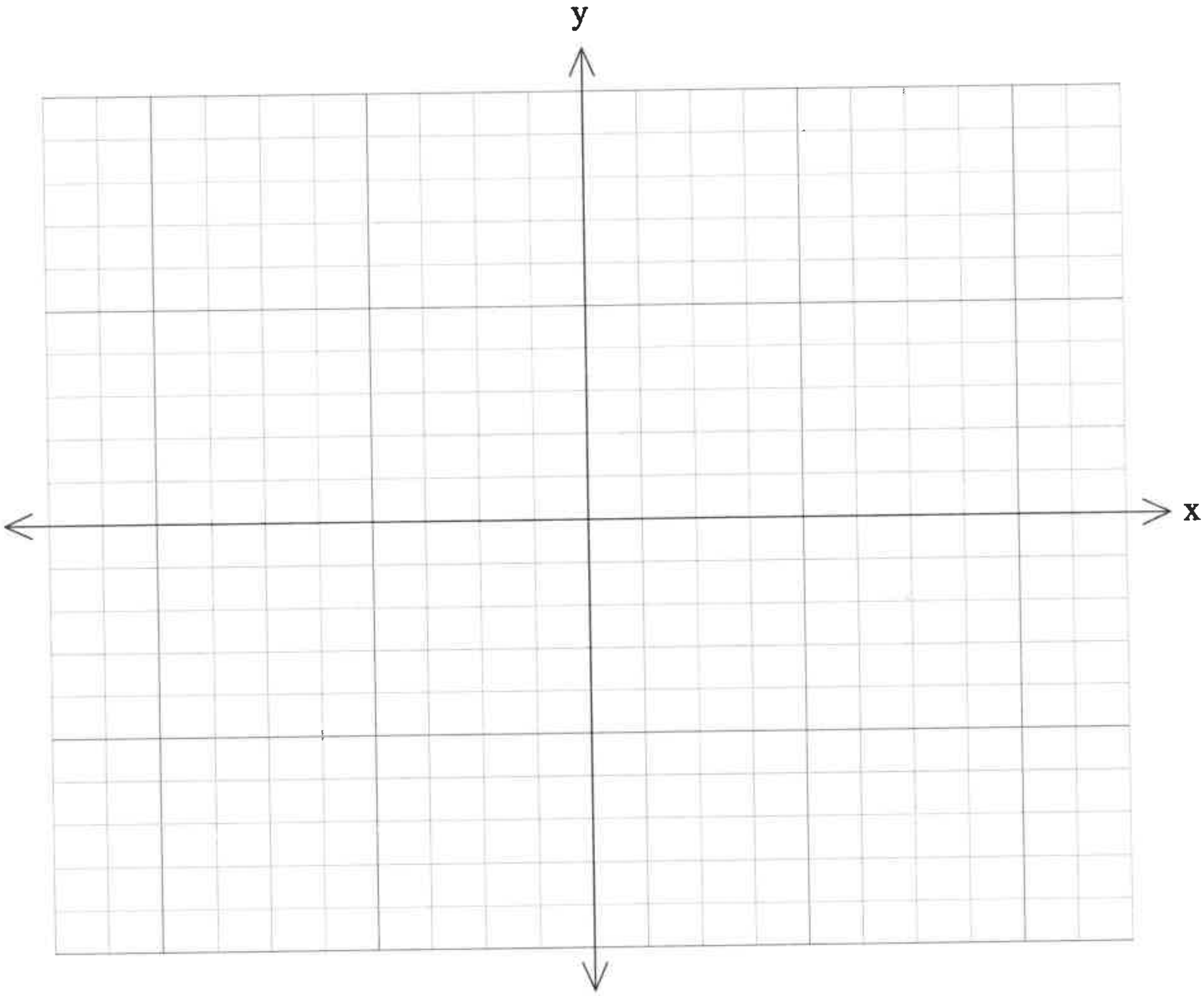
Spare diagram used (✓) ☐

Total C6

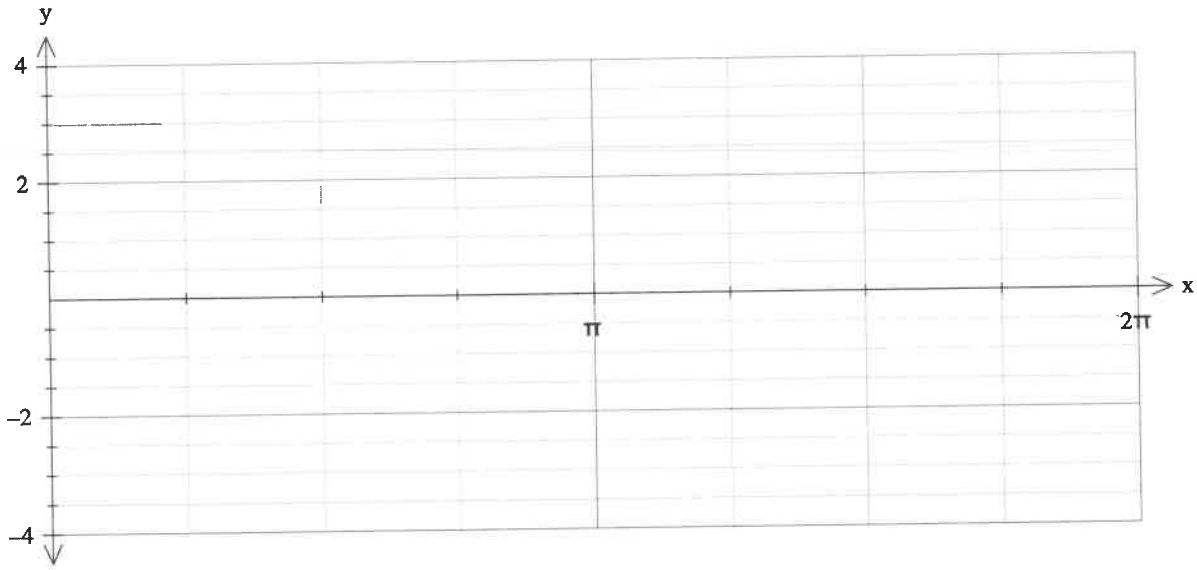
/16

Spare Diagrams

Question 13 a)



Question 15 b)



Part 4

- Attempt **all** questions in this part.
- This part assesses **Criterion 7**.

Question 16

Marker use

Differentiate the following with respect to x.

a) $y = 5x^4 - 7x^3 + 6x$

$\frac{dy}{dx} = 20x^3 - 21x^2 + 6$

1

b) $y = 2(x+2)(x-3)$

$y = 2(x^2 - x - 6)$

$y = 2x^2 - 2x - 12$

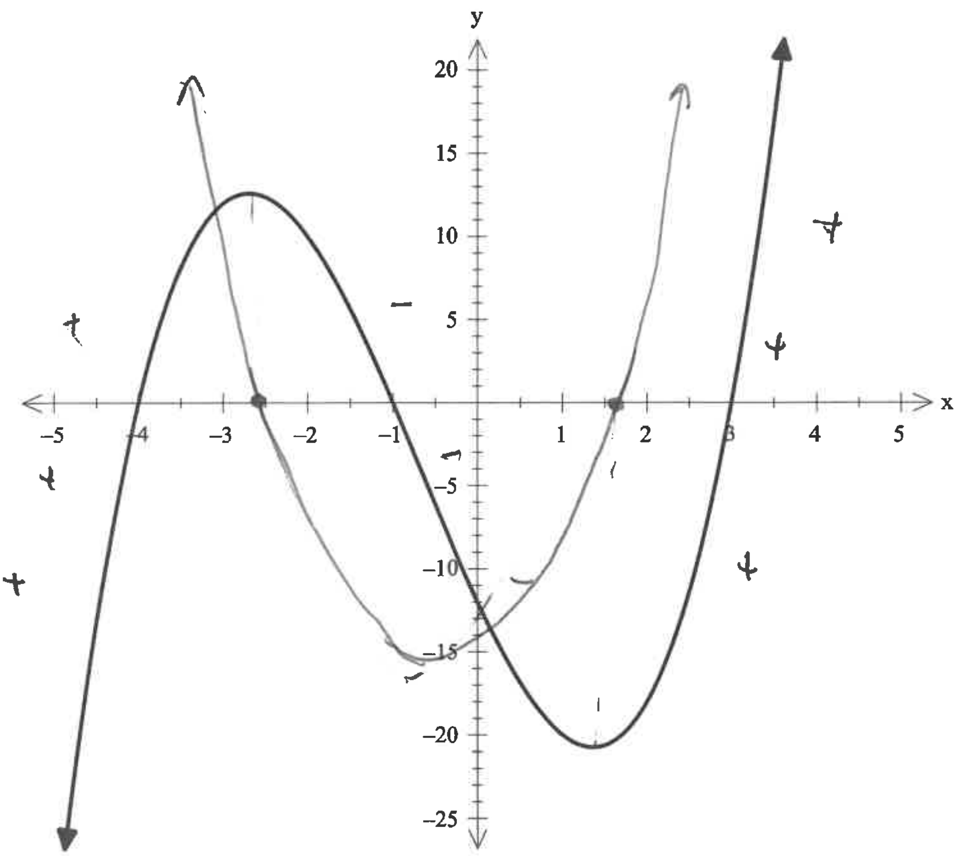
$\frac{dy}{dx} = 4x - 2$

2

Question 17

For the function shown, sketch the graph of an approximate corresponding gradient function.

2



Spare diagram used (✓)

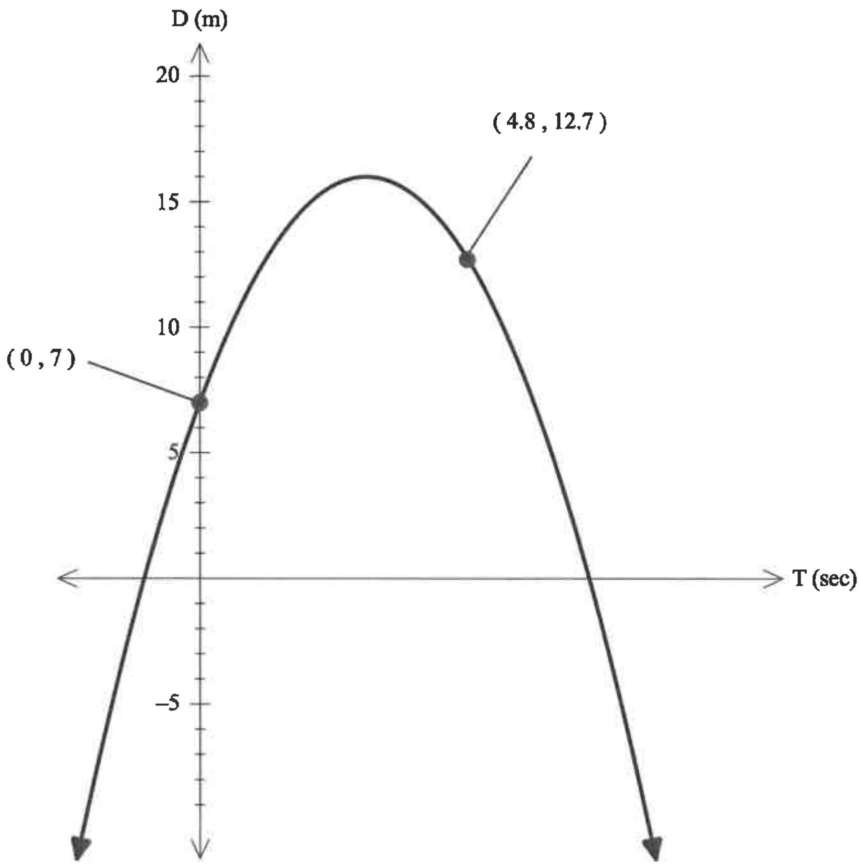
Part 4 continues

Marker use

Question 18

Calculate the average rate of change between the two points marked on the graph. Include appropriate units.

/ 2



Av. rate of change $= \dfrac{12.7 - 7}{4.8 - 0}$

$= \dfrac{5.7}{4.8}$

$= \dfrac{57}{48}$ m/s

Part 4 continues

Part 4 continued

Question 19

Find the equation of the tangent at the point on the curve $y = x^2 + 2x - 3$, where the gradient is 4.

$\frac{dy}{dx} = 2x + 2$

$2x + 2 = 4$

$2x = 2$

$x = 1$

$y = (1)^2 + 2(1) - 3$

$= 0$

$y - 0 = 4(x - 1)$

$y = 4x - 4$

Marker use

/3

Question 20

A particle moves in a straight line such that its displacement, s (kilometres), from a fixed origin at time t (hours) is $s = 4t^2 - 8t,\ t \geq 0$.

a) Evaluate the **displacement** at $t = 1$ and $t = 3$.

$s = 4(1)^2 - 8(1)$

$= -4$ km

$s = 4(3)^2 - 8(3)$

$= 36 - 24$

$= 12$ km

/2

b) Determine the **average velocity** of the particle between 1 and 3 hours.

Av. velocity $= \frac{12 - {}^-4}{3 - 1}$

$= \frac{16}{2} = 8$ km/h

/2

c) Determine the **instantaneous velocity** $\left(v = \frac{ds}{dt}\right)$ of the particle when $t = 5$ hours.

$\frac{ds}{dt} = 8t - 8$

$= 8 \times 5 - 8$

$= 32$ km/h

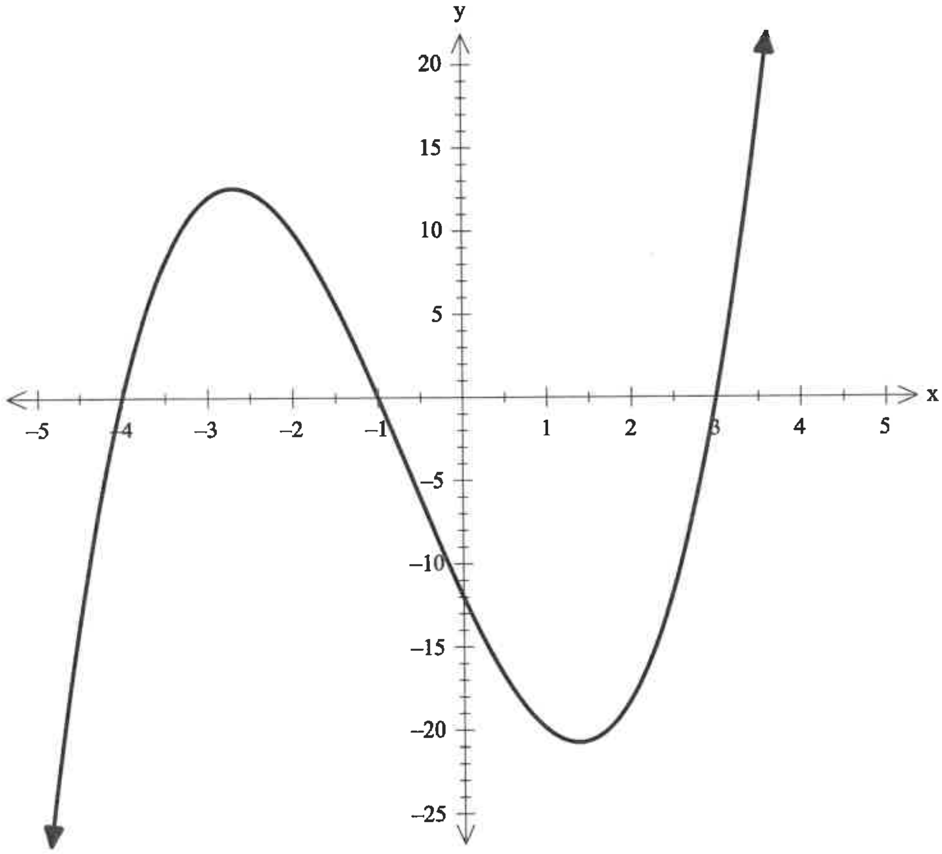
/2

Total C7

/16

Spare Diagrams

Question 17



Part 5

- Attempt **all questions** in this part.
- This part assesses **Criterion 8**.

Question 21

Marker use

A group was surveyed in relation to their choice of cuisine. From the results, it was noted that if a member of the group was chosen at random, the probability they ate pizza (P) was 0.7, the probability they ate sushi (S) was 0.6 and the probability they ate neither pizza nor sushi was 0.2.

a) Complete this probability table using this information. /2

	P	P'	
S	0.5	0.1	0.6
S'	0.2	0.2	0.4
	0.7	0.3	1

Spare diagram used (✓) ☐

b) Find the probability that a randomly chosen group member:

i. Ate pizza but not sushi. /1

$Pr(P \cap S') = 0.2$

ii. Ate pizza and sushi. /1

$Pr(P \cap S) = 0.5$

Question 22

Rachel likes to read. She has 8 crime fiction and 5 fantasy novels on her bookshelf. If she chooses a book at random, find the probability she chooses:

a) A crime fiction book. /1

$Pr(CF) = \frac{8}{13}$

b) A crime fiction book followed by a fantasy novel if she **does not replace** the first book before she draws the second. /1

$Pr(CF, F) = \frac{\cancel{8}^{2}}{13} \times \frac{5}{\cancel{12}_{3}}$

$= \frac{10}{39}$

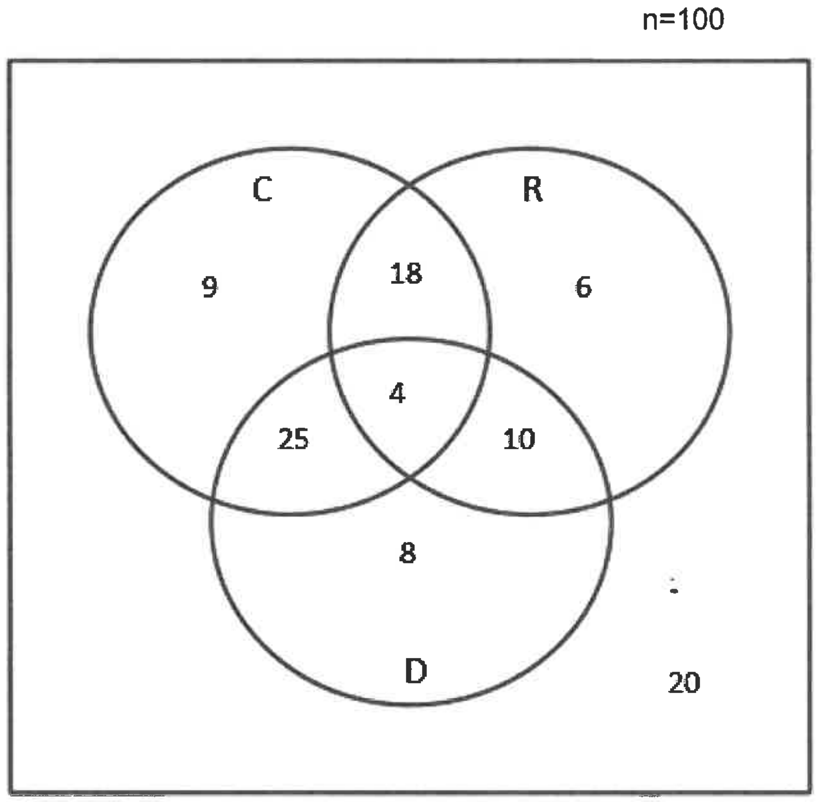
Part 5 continues

Part 5 continued

Marker use

Question 23

Jim's Vet Hospital did a survey of their 100 pet owners. The information they gathered about the pets they owned was placed in the Venn diagram below with D for dogs, C for cats and R rabbits.



a) What is the probability the next pet owner Jim sees owns a dog?

$Pr(D) = 47/100$

/1

b) Calculate the probability that a pet owner owns a rabbit given that they own a dog $\Pr(R|D)$.

$Pr(R|D) = \frac{Pr(R \cap D)}{Pr(D)}$

$= 14/47$

/2

c) Calculate $\Pr(D'|(R \cap C')$.

$Pr(D'|(R\cap C') = \frac{Pr(D' \cap (R \cap C'))}{Pr(R \cap C')}$

$= \frac{6}{16}$

$= 3/8$

/2

Part 5 continues

Part 5 continued

Marker use

Question 24

For two events A and B, $\Pr(A)=0.6$ and $\Pr(B)=0.4$.

a) Find $\Pr(A\cap B)$ if:

i. Events A and B are independent. /2

$\Pr(A\cap B) = \Pr(A) \times \Pr(B)$

$= 0.6 \times 0.4 \quad = 0.24$

ii. Events A and B are mutually exclusive. /1

$\Pr(A\cap B) = 0$

b) If $\Pr(A\cap B)=0.2$, find $\Pr(B|A)$. /2

$\Pr(B|A) = \dfrac{\Pr(A\cap B)}{\Pr(A)}$

$= \dfrac{0.2}{0.6}$

$= 2/6$

$= 1/3$

Total C8

/16

Spare Diagram

Question 21 a)

	P	P'	
S			
S'			

Blank Page

End of Section A

OFFICE OF TASMANIAN ASSESSMENT, STANDARDS & CERTIFICATION

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External Assessment 2022

ANSWERS/SOLUTIONS

29 JUL 2022

MATHEMATICS METHODS FOUNDATION

MTM315117

Section B

Pages	28
Questions	24
Information Sheet	1

Suggested working time: 100 minutes

Instructions:

Calculators are allowed to be used.

- There are **five (5)** parts to this section.
- Answer **all** questions and **all** items within each question.
- Write your answers in the spaces provided in this exam paper.
  - Spare diagrams have been provided at the end of each part. Indicate in the box provided if you have used the spare diagrams.
- The exam is **three (3)** hours in length. It is suggested that you spend **approximately 100 minutes** in total answering the questions in this exam booklet.
- During the first 80 minutes you may move onto Section B, but you **cannot** use your calculator until told by your supervisor (s).
- The **Mathematics Methods Foundation Information Sheet** can be used throughout the exam.
- All answers must be written in **English**.
- You **must** make sure your answers address:
  - Criterion 4 manipulate algebraic expressions and solve equations
  - Criterion 5 understand linear, quadratic and cubic functions
  - Criterion 6 understand logarithmic, exponential and trigonometric functions
  - Criterion 7 use differential calculus in the study of functions
  - Criterion 8 understand experimental and theoretical probabilities and of statistics.

Marker Use	
C4	/ 20
C5	/ 20
C6	/ 20
C7	/ 20
C8	/ 20

Additional Exam Instructions

For questions worth **one (1)** mark, you are not required to show workings. Markers will look at the presentation of the answer(s) and at the argument(s) leading to the final answer(s).

For questions worth **two (2)** or more marks **you are required** to show relevant workings.

Marks will be allocated:

- according to the degree to which workings convey a logical line of reasoning, and
- for suitable justifications and explanations of methods and processes when requested.

Guide to Exam Structure

	Parts	Questions available	Questions to answer	Suggested working time	Marks available
Section A	Part 1	6	6	16 minutes	16
	Part 2	5	5	16 minutes	16
	Part 3	4	4	16 minutes	16
	Part 4	5	5	16 minutes	16
	Part 5	4	4	16 minutes	16
Totals		24	24	80 minutes	80
Section B	Part 1	5	5	20 minutes	20
	Part 2	4	4	20 minutes	20
	Part 3	6	6	20 minutes	20
	Part 4	5	5	20 minutes	20
	Part 5	4	4	20 minutes	20
Totals		**24**	**24**	**100 minutes**	**100**
Totals		**48**	**48**	**180 minutes (3 hours)**	**180**

Part 1

- Attempt **all** questions in this part.
- This part assesses **Criterion 4**.

Question 25

Marker use

Pickleball was the fastest growing sport in Australia in 2021. A sports store supplies 24 paddles (P) and 16 sets of balls (B) to one school for \$1160, and 20 paddles and 8 sets of balls to another school for \$860. Delivery is free.

a) Set up **two (2)** equations to model this scenario.

$24P + 16B = 1160$ ①

$20P + 8B = 860$ ② $\times 2$

/1

b) Solve your equations, **showing full algebraic working**, to find the prices that the schools paid for paddles and balls.

/3

$24P + 16B = 1160$ ①

$40P + 16B = 1720$ ③

③ − ①

$16P = 560$

$P = 35$

sub $P = 35$ in ②

$20 \times 35 + 8B = 860$

$700 + 8B = 860$

$8B = 160$

$B = 20$

∴ paddles cost \$35

balls cost \$20

Part 1 continues

Marker use

Question 26

a) Without dividing, show that $(x+2)$ is a factor of $x^3 - 5x^2 - 2x + 24$

$P(-2) = (-2)^3 - 5(-2)^2 - 2 \times {}^-2 + 24$

$= -8 - 20 + 4 + 24$

$= 0 \quad \therefore (x+2)$ is a factor

/1

b) Fully factorise $x^3 - 5x^2 - 2x + 24$

	x^2	$-7x$	$+12$
x	x^3	$-7x^2$	$+12x$
$+2$	$2x^2$	$-14x$	$+24$

$(x+2)(x^2 - 7x + 12)$

$(x+2)(x-3)(x-4)$

/3

c) Hence, solve $x^3 + 24 = 5x^2 + 2x$ for x

$x^3 - 5x^2 - 2x + 24 = 0 \qquad x = {}^-2$ or $x = 3$ or $x = 4$

$(x+2)(x-3)(x-4) = 0$

/2

Question 27

For the following formula:

$$g = \sqrt{5C - r}$$

a) State the value of g when C is 24.1 and r is 5.2. Give your answer to 1 decimal place.

$g = \sqrt{5 \times 24.1 - 5.2}$

$= 10.7$ (1dp)

/1

b) Make C the subject of the equation.

$g^2 = 5C - r$

$g^2 + r = 5C$

$C = \dfrac{g^2 + r}{5}$

/2

Part 1 continues

Part 1 continued

Marker use

Question 28

Give exact solutions to $x^2 - 6x + 4 = 0$ using the quadratic formula.

$x = \dfrac{6 \pm \sqrt{(-6)^2 - 4 \times 1 \times 4}}{2}$

$x = \dfrac{6 \pm \sqrt{20}}{2}$ $\quad x = 3 \pm \sqrt{5}$

/2

Question 29

Consider $3x^2 + 2x + c = 0$.

a) Show that the discriminant is $\Delta = 4 - 12c$.

$a = 3 \quad b = 2 \quad c = c \quad \Delta = 4 - 12c$

$\Delta = 2^2 - 4 \times 3 \times c$

/1

b) Hence find the values of c for which the equation has:

i. One real root.

$\Delta = 0 \quad 4 - 12c = 0$

$12c = 4$

$c = \frac{1}{3}$

/2

ii. Rational roots (only one value needs to be given).

rational roots $\Delta > 0$, perfect square.

$4 - 12c = 1$ or $4 - 12c = 4$

$-12c = -3 \quad c = 0$

$c = \frac{1}{4}$ etc.

/2

Total C4

/20

Section B continues

Part 2

- Attempt **all** questions in this part.
- This part assesses **Criterion 5**.

Marker use

Question 30

SYDNEY-HARBOUR-BRIDGE-0037 Photo © Ilya Genkin (online image) Available at:
***Source:**http://www.genkin.org/cgi-bin/photo.pl/australia/sydney/hb/au-sydney-harbour-bridge-0037 [Accessed 16 April 2022]*

An approximate equation for the lower arch of the Sydney Harbour Bridge is:

$$y = -0.002(x - 250.5)^2 + 125.5$$

where y is the height of the arch from water level and x is the horizontal distance from one end. Both x and y are in metres.

a) Find the turning point and discuss its significance in terms of the structure.

TP (250.5 , 125.5)

at 250.5m from one end, the height of the arch is at a max. from the water level of 125.5m

/ 2

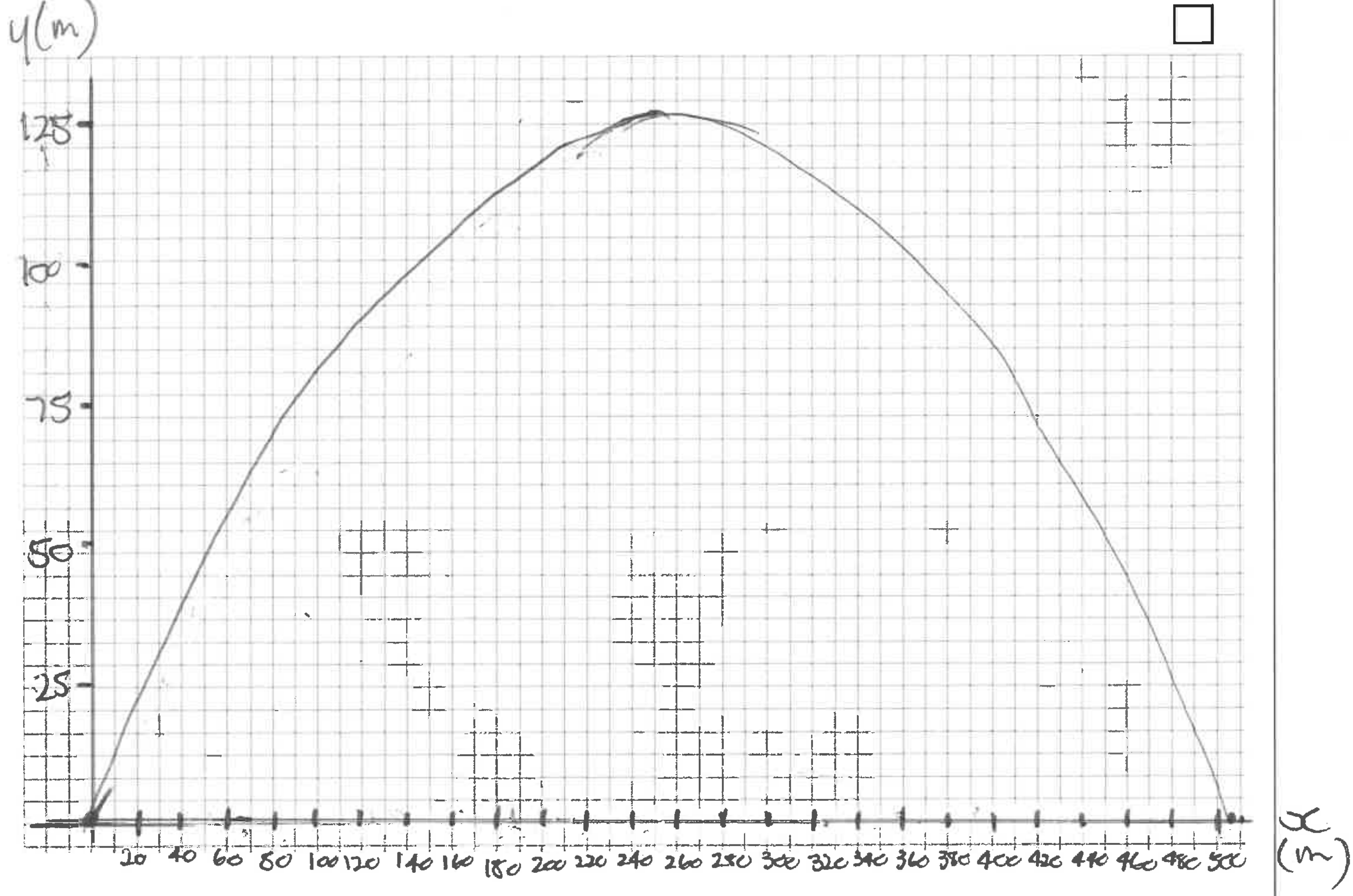
Question 30 continues

Question 30 continued

b) **Using your calculator to assist**, draw a sketch of this curve for an appropriate domain. Clearly label intercepts and endpoint.

Spare diagram used (✓) ☐

Marker use /3



c) Find the width of the arch at water level. /1

$-0.002(x-250.5)^2 + 125.5 = 0$

$x = 0.0004999 \quad x = 501$

$\therefore$ Width = 501m

OR realise the TP is in the middle $\therefore 2 \times 250.5$

d) The roadway passes through the arch at 63.75m above water level. Find the length of the road which passes through the arch the nearest m. /2

$-0.002(x-250.5)^2 + 125.5 = 63.75$

$x = 74.7$ OR 426.2

length of road $= 426.2 - 74.7$

$= 351.5$m

Part 2 continues

Part 2 continued

Marker use

Question 31

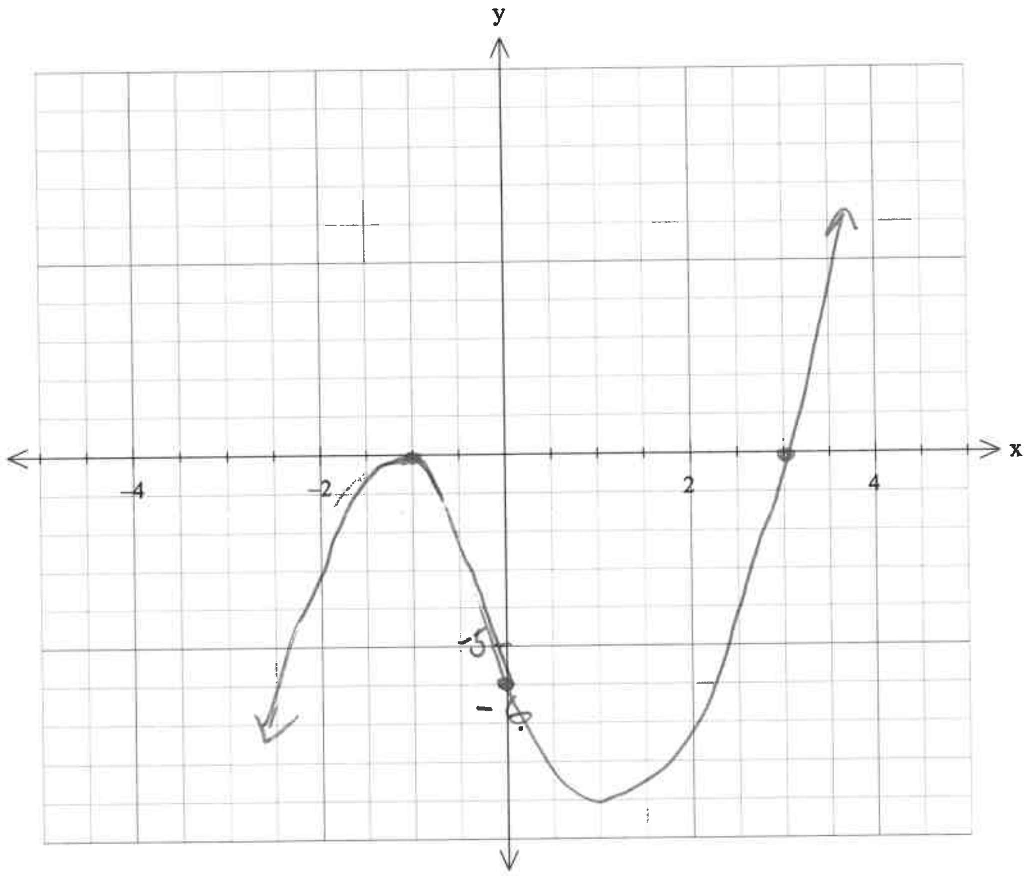
Sketch the function $y = 2(x-3)(x+1)^2$, clearly indicating all intercepts. Turning points are not required.

x int $y=0$ | y int $x=0$

$2(x-3)(x+1)^2=0$ | $y=2(-3)(1)^2$

$x=3$ or $x=-1$ | $=-6$

R double



Spare diagram used (✓)

/3

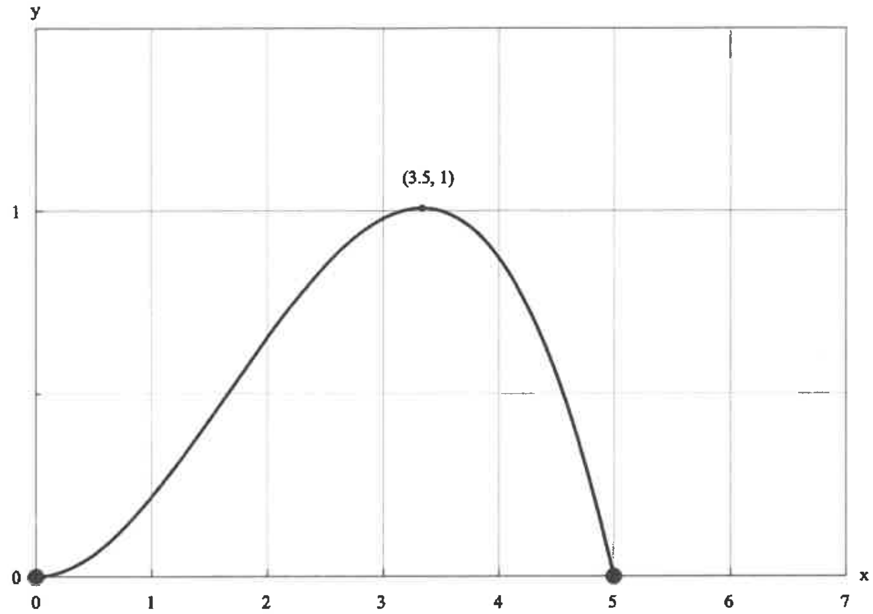
Part 2 continues

Part 2 continued

Marker use

Question 32

A school has a tunnel in the playground which can be modelled by the equation $y = ax^2(x-b)$.
A cross section of the tunnel is shown by the diagram below. All measurements are in m.



a) Show that $a = -0.0544$ and $b = 5$. /2

x ints at 0 and 5 $\qquad ax^2(x-b) = 0$

$1 = a(3.5)^2(3.5-5) \qquad x = 0$ OR $x = b$

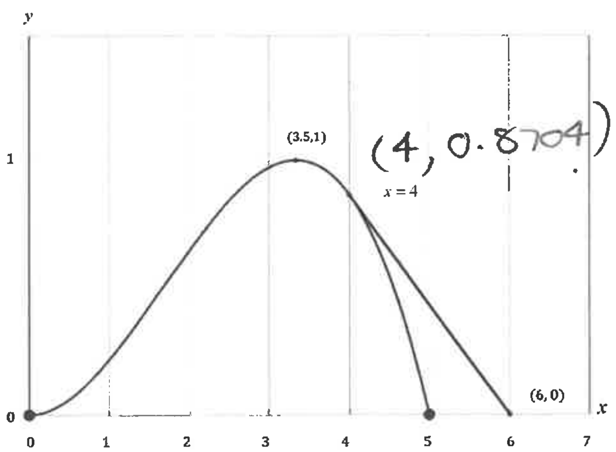
$a = \frac{1}{-18.375} = -0.0544 \qquad$ since int at 5, $b = 5$

b) Hence find the height of the tunnel at $x = 4$ m. /1

$y = -0.0544(4)^2(4-5)$

$= 0.8704$ m

c) A group of students lean a ladder against the outside of the tunnel (as shown in the diagram).
Find the gradient of the ladder. /2



$m = \frac{0 - 0.8704}{6 - 4}$

$= -0.4352$

Part 2 continues

Part 2 continued

Marker use

Question 33

The following transformations are applied to $f(x) = x^2$:

- Dilated by a factor of 3 in the direction of the y axis $3x^2$
- Translated right 2 units $3(x-2)^2$
- Translated down 5 units $3(x-2)^2 - 5$

a) State the equation of the new function.

$f(x) = 3(x-2)^2 - 5$

/2

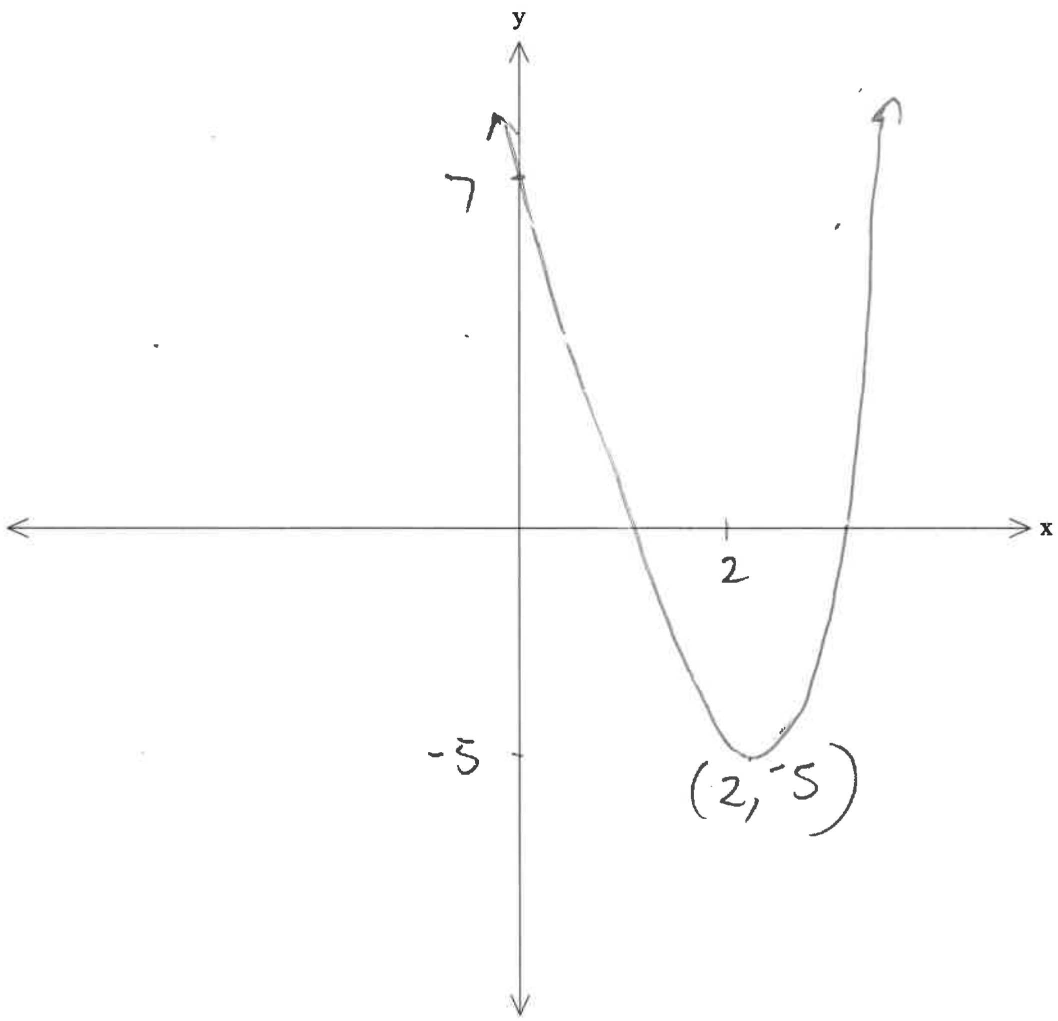
b) Sketch the graph of the new function, clearly indicating the turning point and the y intercept (x intercepts are not required).

/2

y int $x=0$

$y = 3(-2)^2 - 5$

$= 7$



Spare diagram used (✓)

☐

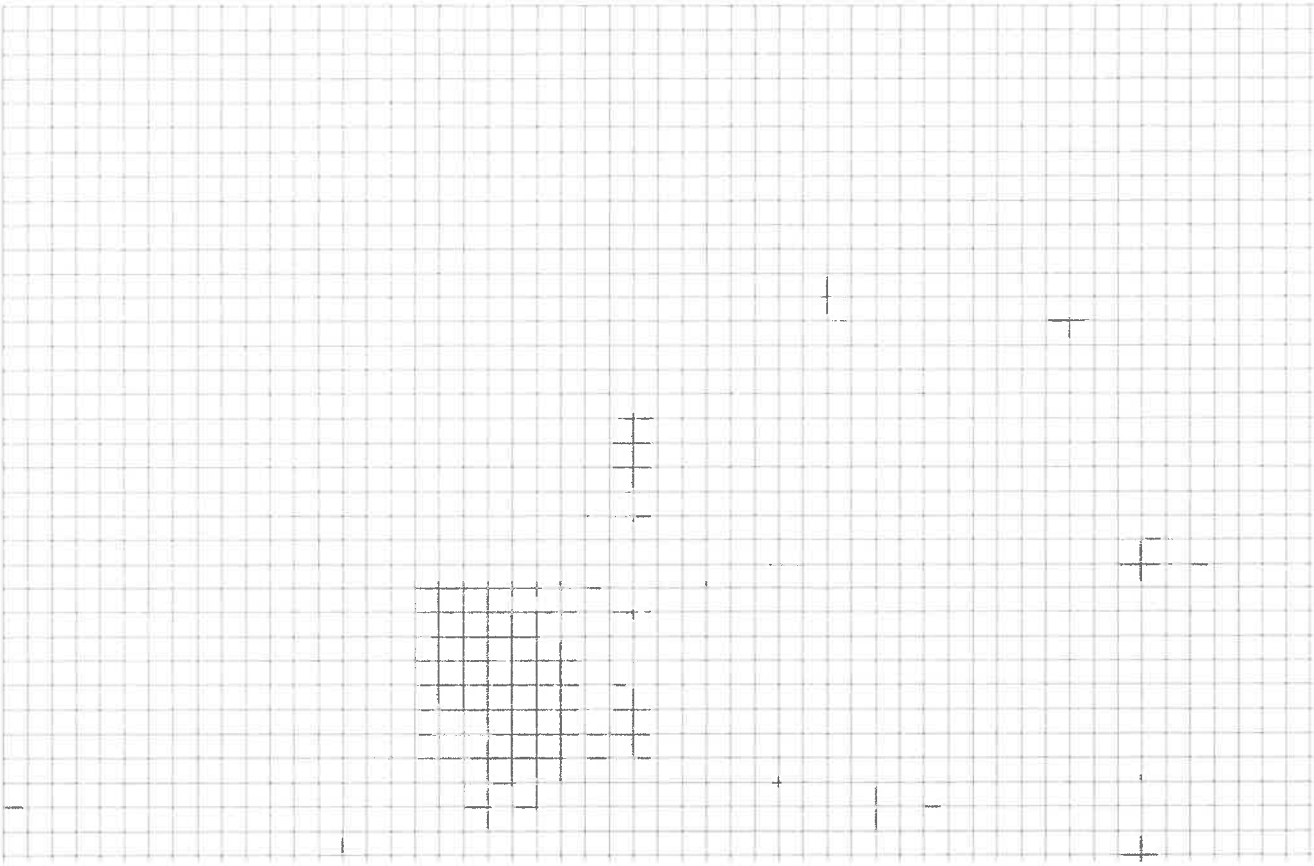
Total C5

/20

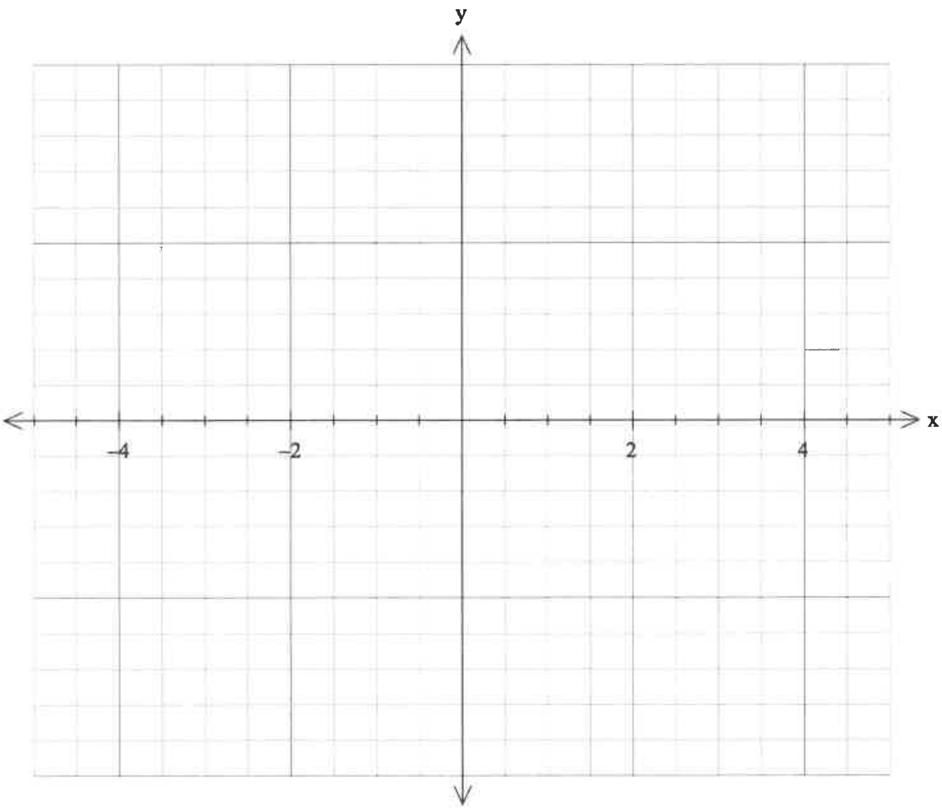
Section B continues

Spare Diagrams

Question 30 b)

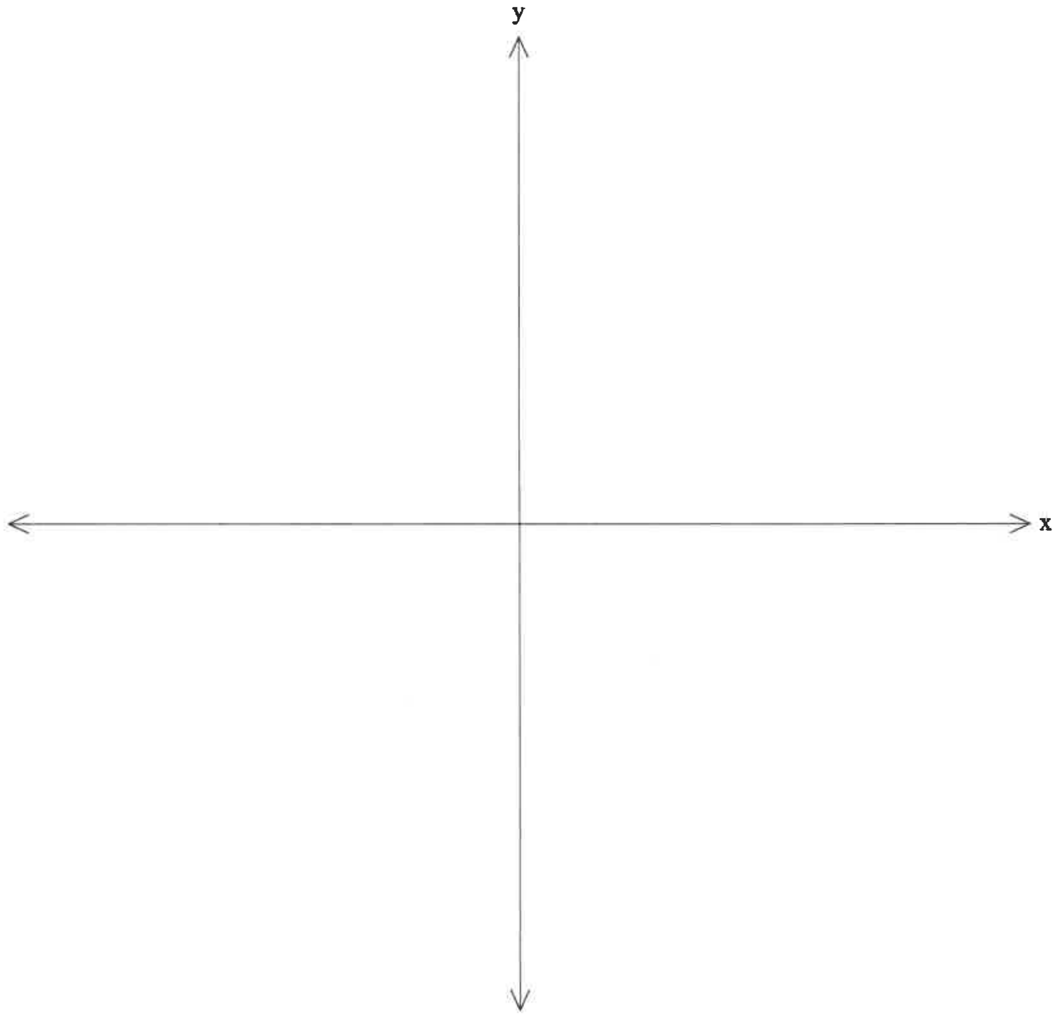


Question 31



Spare Diagrams

Question 33 b)



Section B continues

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Exam continues over the page

Part 3

- Attempt **all** questions in this part.
- This part assesses **Criterion 6**.

Question 34

Marker use

If $\sin x = -\cos x$ and $x \in \left[\frac{\pi}{2}, \pi\right]$, determine the value of x.

1

$\frac{\sin x}{\cos x} = -1$

$x = \frac{3\pi}{4}$

Question 35

The value of a car, $\$V$, decreases according to the function $V = 30000(0.6)^{0.2n}$ where n is the number of years since the car was purchased.

a) Find the value of the car when it was purchased. $n = 0$

1

$V = \$30\,000$

b) How many years until the car is worth \$15 000? Answer to 2 decimal places.

2

$15\,000 = 30\,000(0.6)^{0.2n}$

$0.5 = (0.6)^{0.2n}$

$n \approx 6.78$ years

Question 36

If $\sin\theta = -\frac{2}{3}$ and $\frac{3\pi}{2} \leq \theta \leq 2\pi$, use basic identities to find exact values of:

a) $\cos\theta$

2

$(-\tfrac{2}{3})^2 + \cos^2\theta = 1$ $\cos\theta = \frac{\sqrt{5}}{3}$ (+) in 4th quad

$\cos^2\theta = 5/9$

b) $\tan\theta$

1

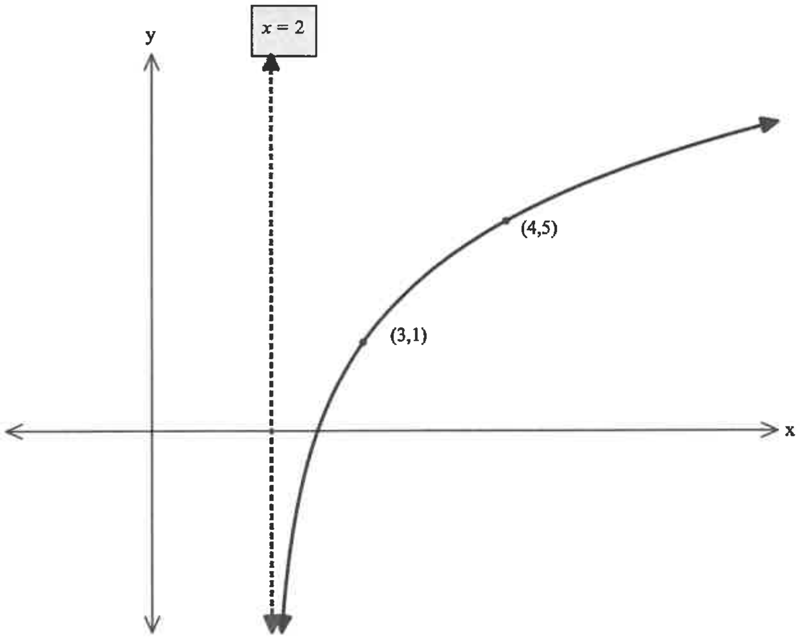
$\tan\theta = \frac{-2/3}{\sqrt{5}/3} = \frac{-2}{\sqrt{5}}$

Part 3 continues

Part 3 continued

Marker use

Question 37



a) Determine the equation of the function represented above if it has the form:

$y = a\log_2(x-h)+k$

$h = 2$ from asymptote

$1 = a\log_2(3-2)+k$

$1 = a\log_2 1 + k$

$k = 1$

$5 = a\log_2(4-2)+1$

$4 = a\log_2 2$

$a = 4$.

$\therefore y = 4\log_2(x-2)+1$

/3

b) State the transformations, in order, to get from $y = \log_2 x$ to the new function above.

- dilated by a factor of 2 in the direction of the y axis
- translated 2 units right
- translated 1 unit up

/2

Part 3 continues

Marker use

Question 38

The temperature in °C on a mountain on a given day is determined by the function:

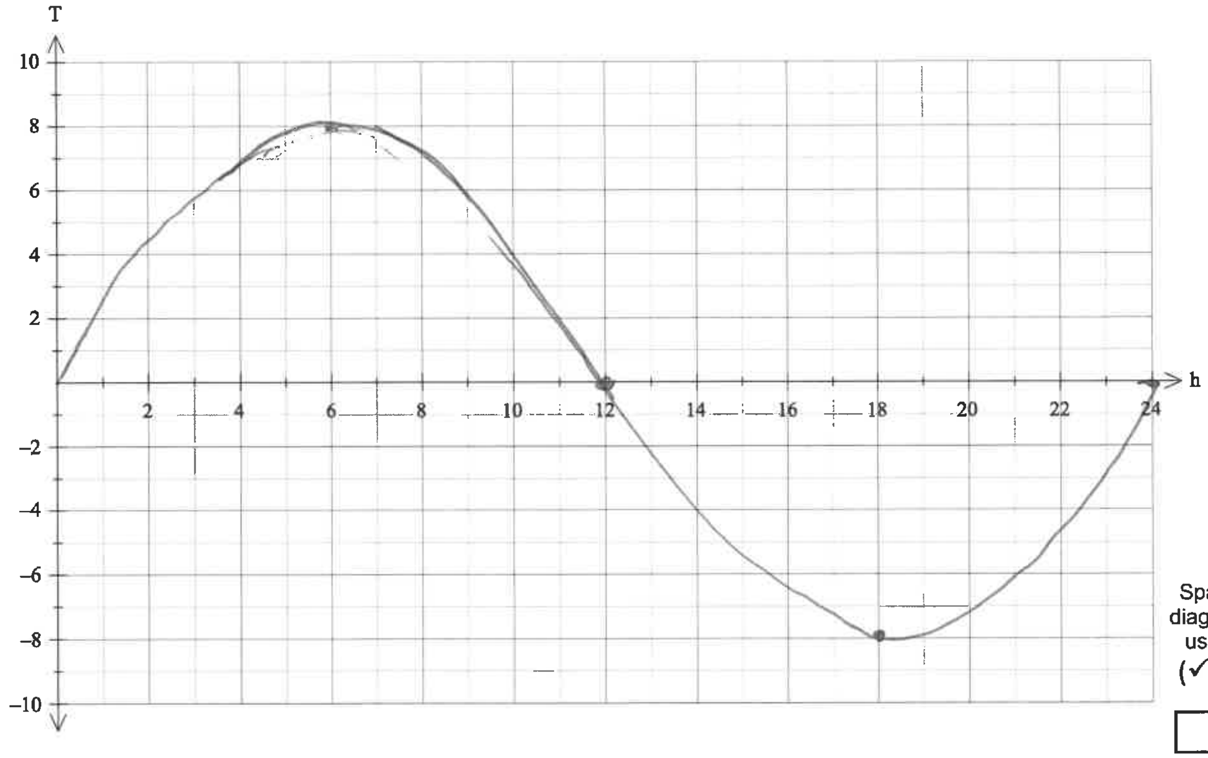
$$T = 8\sin\left(\frac{\pi}{12}h\right), \text{ where } h \text{ is the number of hours } \textbf{after 8am.}$$

a) Determine the period of T.

Period $= \dfrac{2\pi}{\pi/12} = 24$

/1

b) Draw a graph of this function for $0 \le h \le 24$, showing all intercepts.



Spare diagram used (✓)

/3

c) What is the maximum temperature on the mountain and when did it first occur?

Max temp 8° C

6 hrs after 8am → 2pm.

/2

Part 3 continues

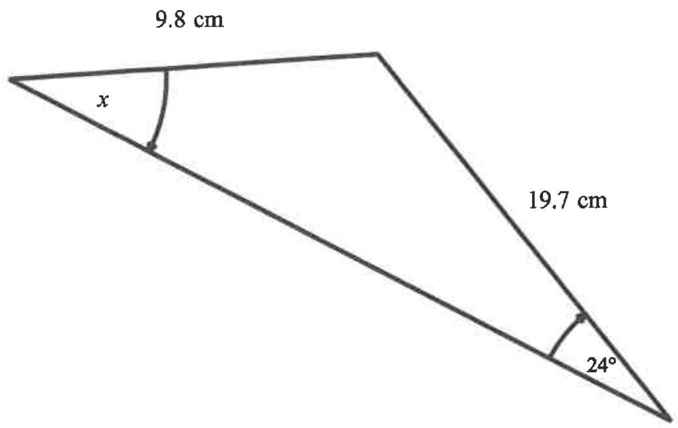
Part 3 continued

Marker use

Question 39

Find the value of x in the following triangle, answer to the nearest degree.

/2



$$\frac{\sin x}{19.7} = \frac{\sin 24^\circ}{9.8}$$

$$\sin x = \frac{19.7 \times \sin 24^\circ}{9.8}$$

$$= 0.817\,624$$

$$x = 54.8476$$

$$\approx 55^\circ$$

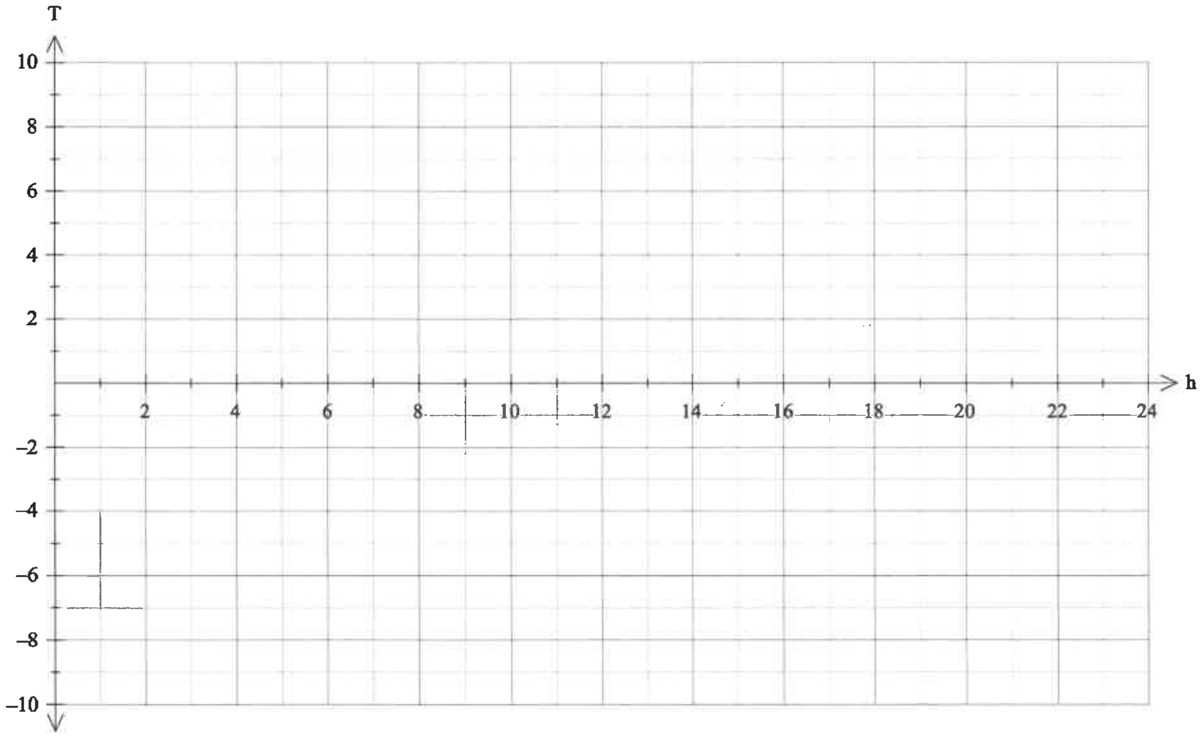
Total C6

/20

Part 3 continues

Spare Diagram

Question 38 b)



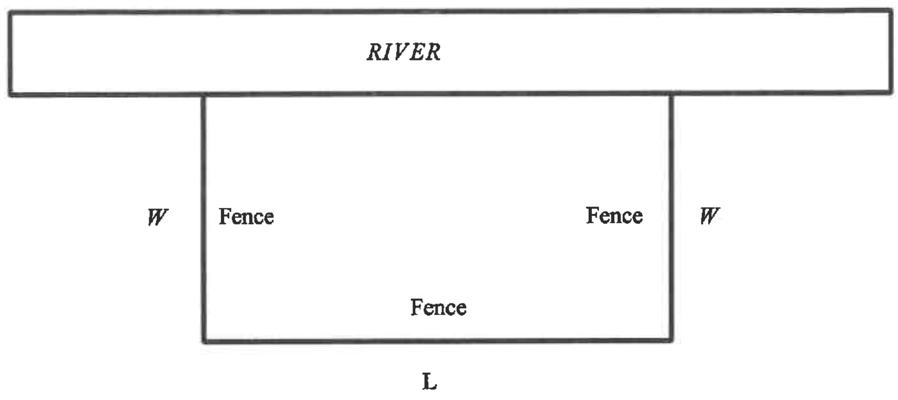
Section B continues

Part 4

- Attempt **all** questions in this part.
- This part assesses **Criterion 7**.

Question 40 | Marker use

A farmer is fencing off a rectangular paddock on a straight stretch of river so they only require three sides of fencing.



a) If the farmer has 200m of fencing, show that $A = 200W - 2W^2$. /2

$2W + L = 200$

$L = 200 - 2W$ $\qquad A = 200W - 2W^2$

$A = LW$

$= W(200 - 2W)$

b) Use calculus to find the width (W) of the paddock needed to make the **area a maximum**. No justification of the maximum is required. /2

For max. $\frac{dA}{dW} = 0$

$\frac{dA}{dW} = 200 - 4W$

$200 - 4W = 0$

$4W = 200$

$W = 50m$

c) Calculate the maximum area. /1

max area $= 200(50) - 2(50)^2$

$= 5000 m^2$

Part 4 continues

Marker use

Question 41

The curve $y = x^3 + ax^2 + bx - 11$ has stationary points when $x = 2$ and $x = 4$. Find the values of a and b.

/3

For SP $\frac{dy}{dx} = 0$

$\frac{dy}{dx} = 3x^2 + 2ax + b$

when $x = 2$ — $x = 4$

$3(2)^2 + 2a \times 2 + b = 0$ — $3(4)^2 + 2a(4) + b = 0$

$12 + 4a + b = 0$ ① — $48 + 8a + b = 0$ ②

② − ①

$36 + 4a = 0$

$4a = -36$

$a = -9$

sub $a = -9$ in ①

$12 - 36 + b = 0$

$-24 + b = 0$

$b = 24$

Question 42

Using first principles, determine the derivative of $f(x) = x^2 - 3x$.

/3

$f(x+h) = (x+h)^2 - 3(x+h)$

$= x^2 + 2xh + h^2 - 3x - 3h$

$f'(x) = \lim_{h \to 0} \frac{\cancel{x^2} + 2xh + h^2 - \cancel{3x} - 3h - (\cancel{x^2} - \cancel{3x})}{h}$

$= \lim_{h \to 0} \frac{2xh + h^2 - 3h}{h}$

$= \lim_{h \to 0} \frac{\cancel{h}(2x + h - 3)}{\cancel{h}}$

$f'(x) = 2x - 3$

Part 4 continues

Part 4 continued

Marker use

Question 43

a) **Use calculus** to find the stationary point(s) of the function $f(x) = x^3 - 3x^2 + 3x + 1$.

/3

SP $f'(x) = 0$ $\quad$ $f(1) = (1)^3 - 3(1)^2 + 3(1) + 1$

$3x^2 - 6x + 3 = 0$ $\quad$ $= 2$

$3(x^2 - 2x + 1) = 0$ $\quad$ $\therefore$ SP $(1, 2)$

$3(x-1)(x-1) = 0$

$x = 1$

b) Justify the nature of the stationary point(s) found in part a).

/2

x	0	1	2
$f'(x)$	+	0	+

(+)ve pt of inflection

Question 44

Find the equation of the normal to the curve $y = 3x^4 - 7x^3 + 6x^2 - 9$ at the point where $x = 1$.

/4

$x = 1$

$y = 3(1)^4 - 7(1)^3 + 6(1)^2 - 9$

$= 3 - 7 + 6 - 9$

$= -7$

$\frac{dy}{dx} = 12x^3 - 21x^2 + 12x - 9$

$m_T = 12(1)^3 - 21(1)^2 + 12(1) - 9$

$= 24 - 21 - 9$

$= -6$

$m_N = \frac{-1}{m_T}$ $\quad$ $y - -7 = \frac{1}{6}(x - 1)$

$= \frac{1}{6}$ $\quad$ $y + 7 = \frac{1}{6}x - \frac{1}{6}$

$y = \frac{1}{6}x - 7\frac{1}{6}$

Total C7

/20

Part 5

- Attempt **all** questions in this part.
- This part assesses **Criterion 8**.

Question 45

Marker use

A mixed netball team of 10 people must be chosen from a group of seven Year 11 students and eight Year 12 students.

a) How many teams are possible:

i. With no restrictions?

$^{15}C_{10} = 3003$

/ 1

ii. If the team has equal numbers of Year 11 and 12 students?

$^{7}C_{5} \times {}^{8}C_{5} = 1176$

/ 2

b) Find the probability the team has equal numbers of Year 11 and Year 12 students.

$Pr(\text{equal}) = \frac{1176}{3003}$

$= 0.391608$

/ 1

Part 5 continues

Question 46

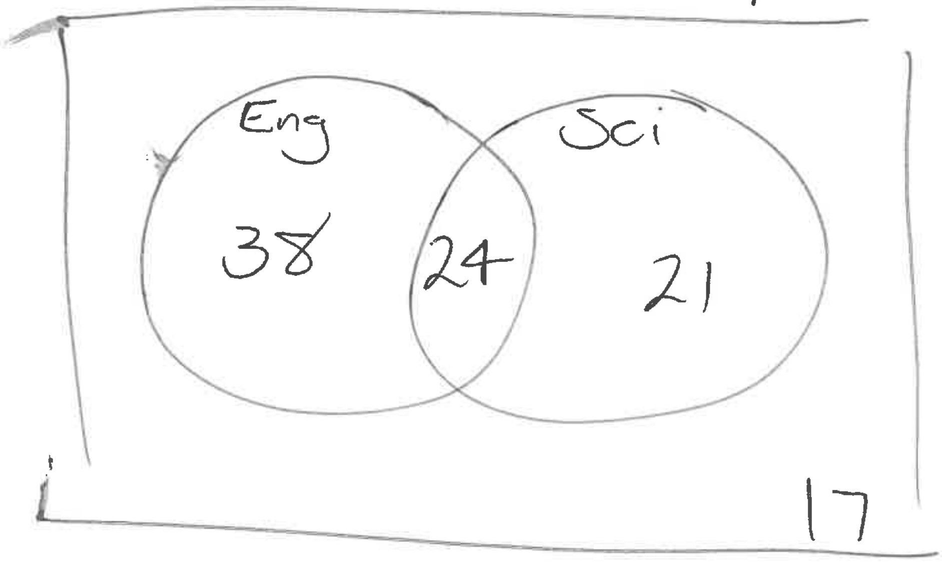
A sample of 100 college students were asked if they studied a Science subject in the current school year and if they studied an English subject in the current year. Of the 100 students sampled, 45 studied a Science subject and 62 studied an English subject. There were 17 who studied neither.

Marker use

a) Construct a Venn diagram to display this information. /2

$$\begin{array}{r} 62+ \\ 45 \\ \hline 107 \end{array} \qquad \begin{array}{r} 107- \\ 83 \\ \hline 24 \end{array}$$

$n = 100$



b) If a student is chosen at random, calculate the probability they:

i. Study Science but not English. /1

$Pr(S \cap E') = \frac{21}{100}$ (0.21)

ii. Study a Science subject given that they study an English subject. /2

$Pr(S|E) = \frac{Pr(S \cap E)}{Pr(E)} = \frac{24}{62}$

$= \frac{12}{31}$ (0.387097)

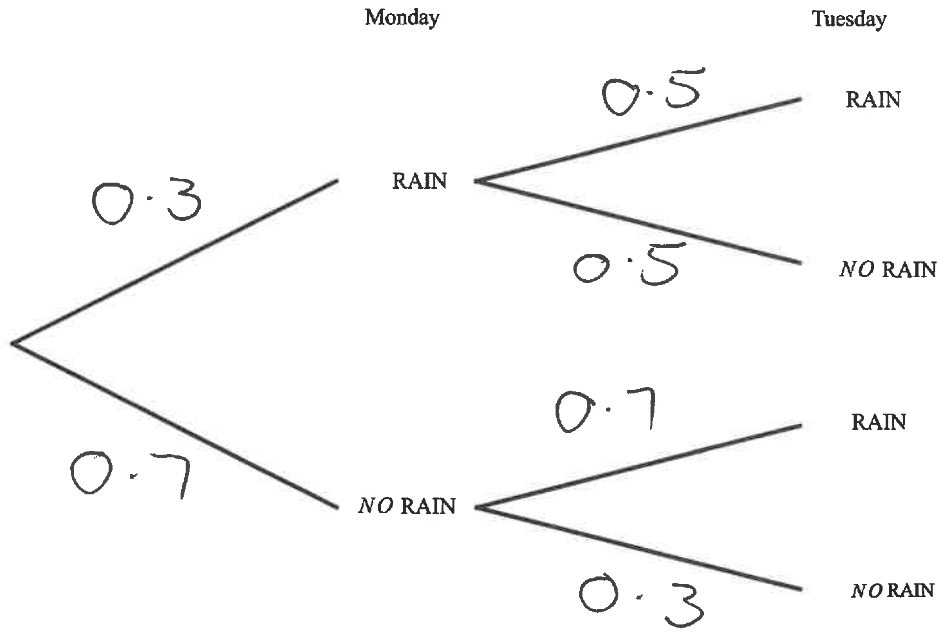
Part 5 continues

Marker use

Question 47

The probability that it will rain Monday is 0.3. If it rains Monday, the probability it will rain Tuesday is 0.5. If it does not rain Monday, the probability it will rain Tuesday is 0.7.

a) Use this information to complete the tree diagram. /2



Spare diagram used (✓) ☐

b) Calculate the probability that it will rain Tuesday. /2

$Pr(\text{rain } T) = 0.3 \times 0.5 + 0.7 \times 0.7$

$= 0.15 + 0.49$

$= 0.64$

c) Show that the events 'it rains Monday' and 'it rains Tuesday' are **not** independent. /2

$Pr(RM \cap RT) = 0.3 \times 0.5 = 0.15$

$Pr(RM) = 0.3$

$Pr(RT) = 0.64$

$Pr(RM) \times Pr(RT) = 0.3 \times 0.64$

$= 0.192 \neq 0.15$

$\therefore$ not independent

Marker use

Question 48

Ash has a tub filled with 26 different toys. They have 8 toys which are animals, 6 dolls and 12 trucks. If Ash randomly pulls **two (2)** toys out of their tub in the dark:

a) How many different combinations of toys could Ash have?

$^{26}C_2 = 325$

/1

b) How many different combinations of **two (2)** toys could Ash have which are from the same category (i.e., both toys are animals, or both are dolls, or both are trucks)?

$^{8}C_2 + {}^{6}C_2 + {}^{12}C_2 = 28 + 15 + 66$

$= 109$

/2

c) What is the probability that Ash pulls out two toys from different categories?

$325 - 109 = 216$

$Pr(2\ diff) = \frac{216}{325}$ (0.664615)

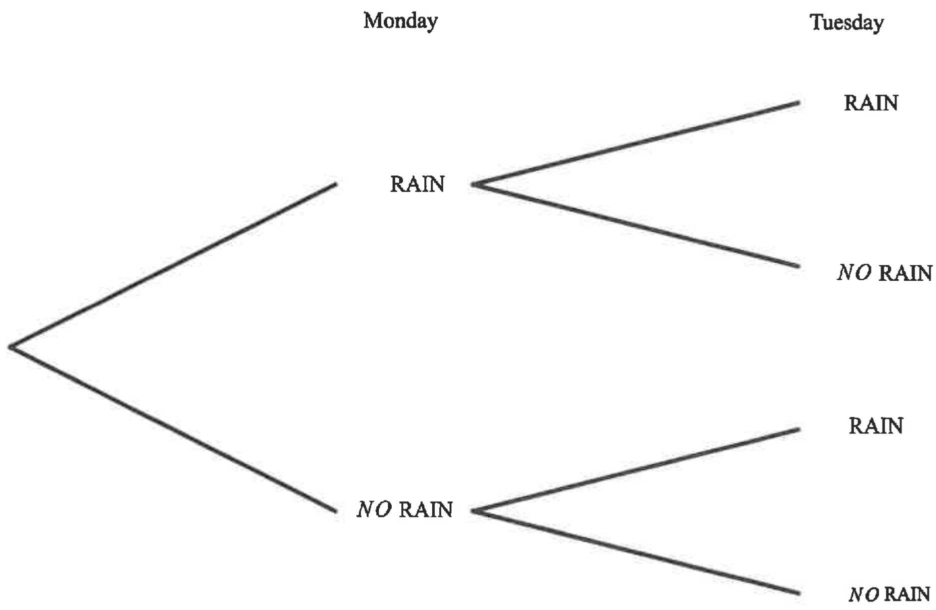
/2

Total C8

/20

Spare Diagram

Question 47 a)



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End of Section B

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